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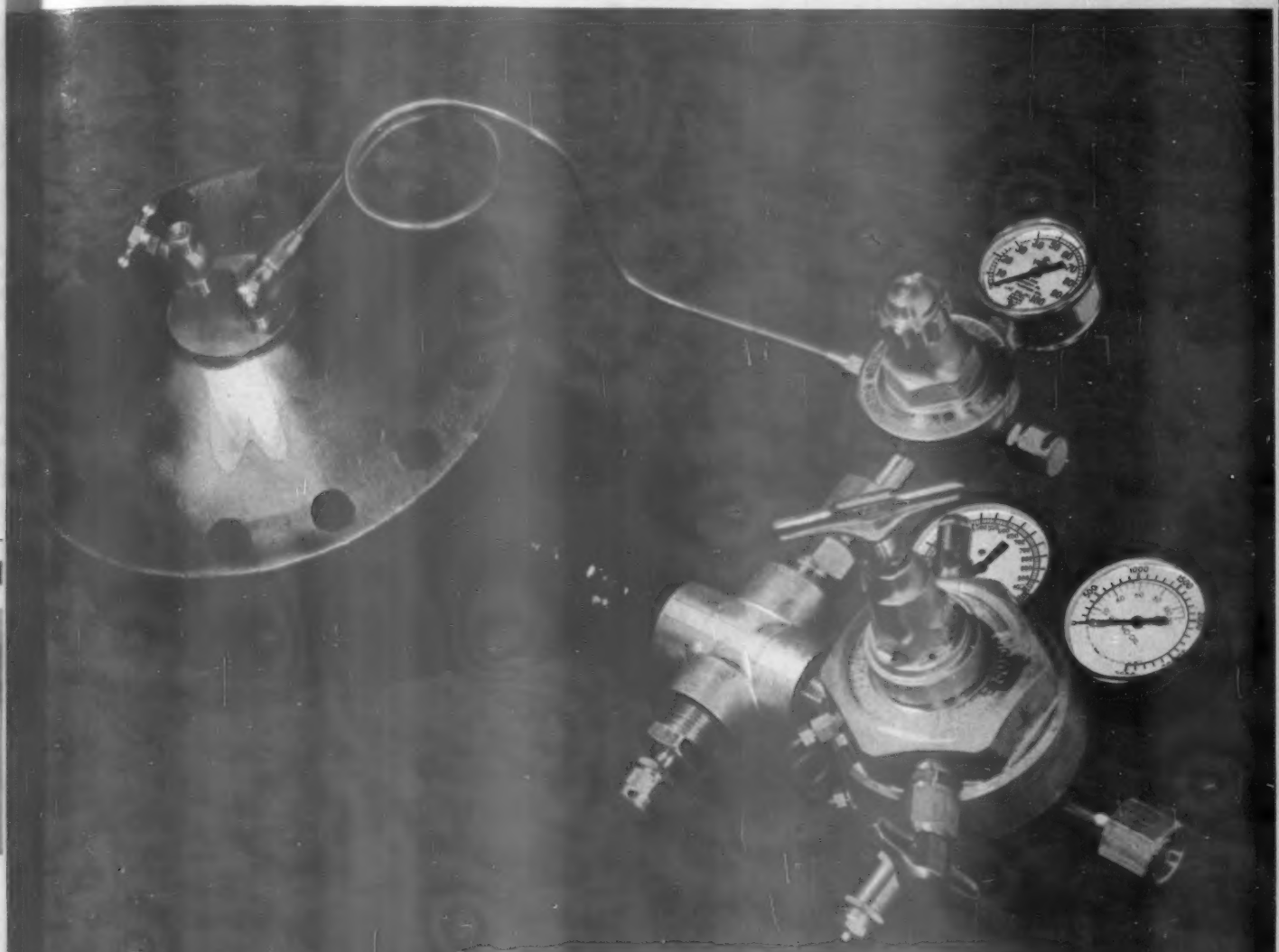
The Welding Engineer

FEBRUARY, 1945

THE PIONEER TECHNICAL PUBLICATION OF THE WELDING INDUSTRY



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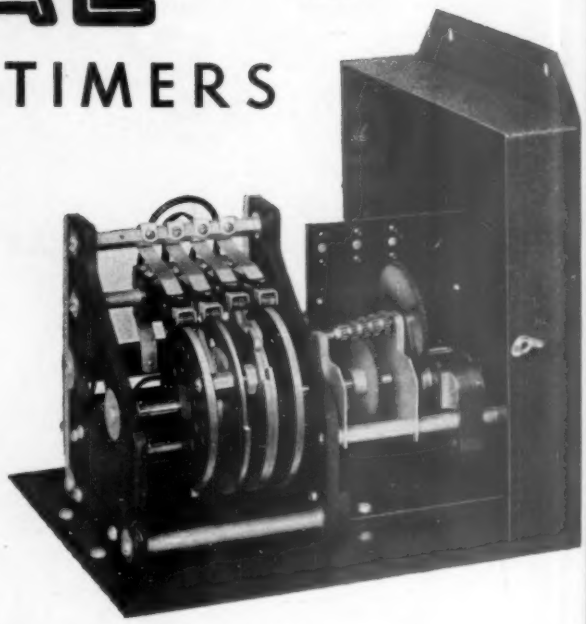

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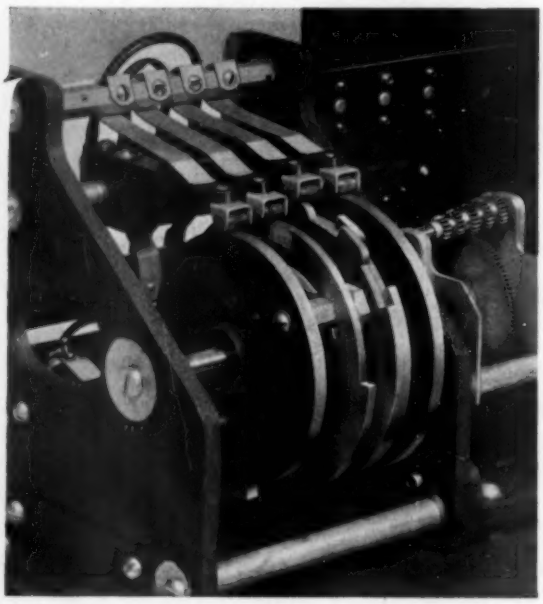

Here's a close-up view of the heart of the new 1945 National Type 1549P Timer. With this fine, precision timer, interrupted welding of heavy metals can be handled properly, and in volume. Heavy metals cannot be fully welded by one charge of current. It has been well established that pumping the heat into the weld two, three or more times, while the pressure to electrodes is held, produces a superior weld-joint. Also, it can be done with less KVA capacity. The 'off' interval between 'on' time *must* be short—not much over one cycle, otherwise metal will cool and form a crust that must be heated all over again. 5 cycles 'on', 1 cycle 'off', repeated 4 times, will weld 2 pieces of 3/16" metal perfectly, with 50 KVA applied. It reduces flashing and burns to a minimum. Even light-gage steel sheets are frequently welded with 2 interruptions, instead of a single spot, to produce a cleaner weld without discoloration.

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The Welding Engineer

AMERICA'S PIONEER WELDING JOURNAL

Established 1916

February's Great Sons

February is the birth month of America's two greatest men. It isn't necessary to name them. They will be forever revered, even in foreign lands.

Vastly different in personality, background and biography, Washington and Lincoln thought alike with regard to fundamentals. Both were firm believers in the necessity of American unity. In word and deed, they fought to create and re-create a nation, not to widen further the rifts of class and sectional hatreds. To both, the United States of America was the greatest nation in the world, and no price was too great to pay to win and maintain our nation's honored place.

Washington succeeded in leading a group of thirteen bickering colonies into a constitutional union, but it remained for Lincoln to weld those colonies and the later states into a true union. His heroic task was nearing completion in 1865 when an assassin's bullet cut short his career.

It may seem strange to some that men of such contrasting environment—Washington was an aristocrat, Lincoln a son of the soil—would work for a common goal. Yet both of these men were noble in every true sense of the word. Class distinction is always conspicuous by its absence in the thinking of those who are truly great. This fact alone does much to account for the growth of America.

As a lad of only nineteen, Washington became a commander of men, and from that time on he managed well the greater and greater responsibilities that destiny laid in his path. Lincoln, in contrast, encountered only pitfalls and defeats until he was 52—just four years before his death! He learned, however, from each fresh disaster. Repeated failures only steeled him for his greatest task of all—four years as wartime President in the most bitter and tragic struggle of our national history.

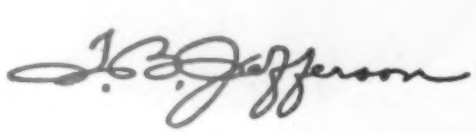
Washington was haughty and stately, a man without emotions or close friends. Lincoln was a homely person of a highly emotional nature, a friend to all who knew him. The contrast is immediately reflected in what they said or wrote. Washington said many fine and profound things, but the ordinary man can only remember the spurious "I did it with my little hatchet." Lincoln, on the contrary, became the most quoted of all public men, and some of his writings have become classics of literature.

Singleness of purpose made both Washington and Lincoln great. They were competent men rather than clever; men more honest than they were ambitious. Emergency conditions brought to each unusual power—power which was freely relinquished as soon as the emergency had passed.

These men did not precipitate great issues but wisely awaited the event. They became great because they performed their duties without a single thought of self-aggrandizement. And by these qualities, Washington and Lincoln became the standards by which the world has since gauged American ideals and abilities.

They set an example that could well be followed more widely today. The principles by which they lived apply not only to the running of a nation but also to the running of a business. Experience has proved that a welding business, for example, will succeed if founded on the principles of honesty, integrity and competence.

May we have more men like February's great sons to lead both our country and our businesses!



New MUREX WALL CHART

A helpful guide to selecting the right Electrode for the job

This new chart, just off the press, contains a complete list of Murex Electrodes divided into four groups for quick reference; mild steel, special steels, stainless steels and hard surfacing. Electrodes are described according to AWS-ASTM class. Color identification, recommended current strengths, polarity, and physical properties are also given. In addition, there are brief descriptions of the electrodes' general characteristics and applications.

The chart is 24" x 37", printed in four colors.

Copies will be sent free to those who request them on their company letterhead.

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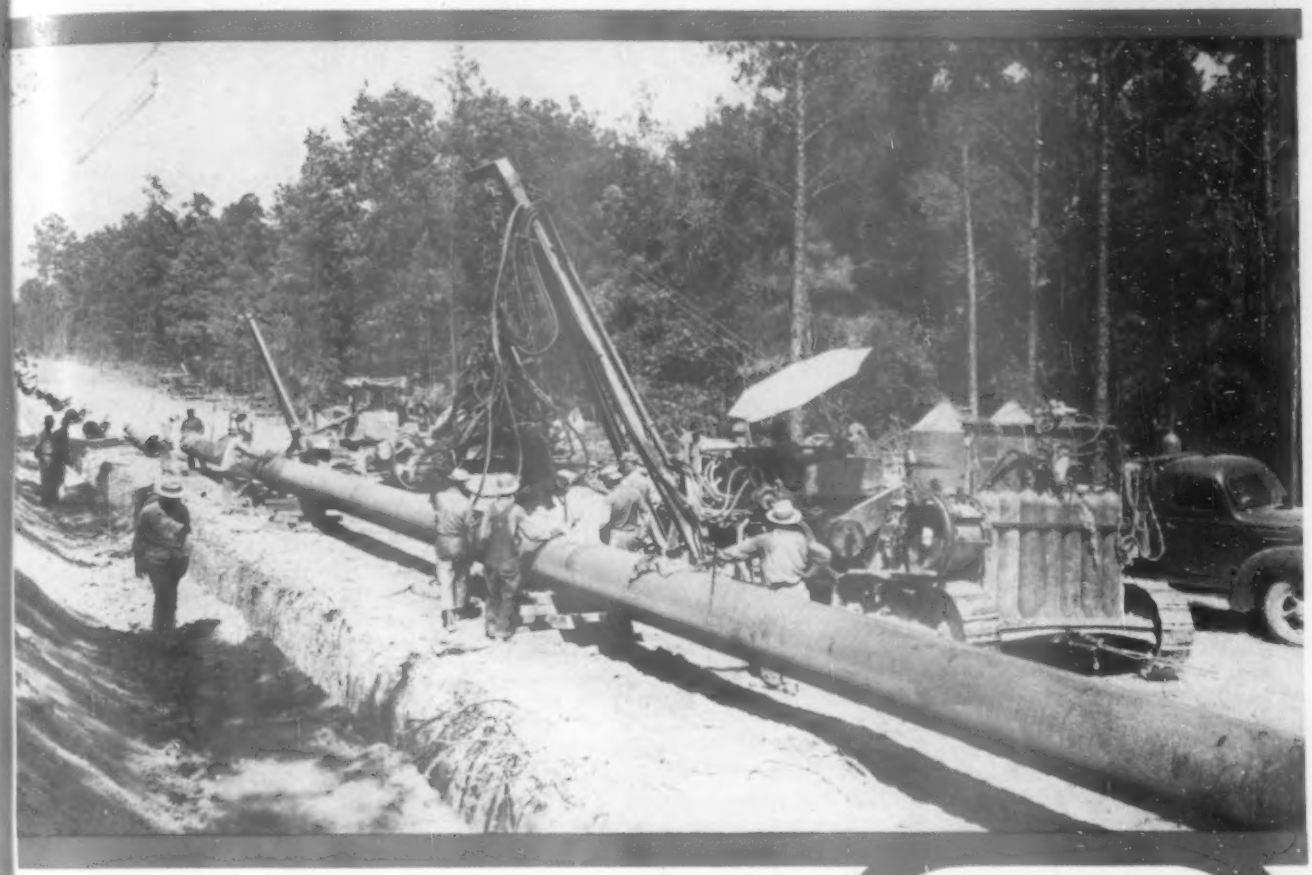


Fig. 1—The entire crew of a pressure-welding "spread" plus two kibitzers (extreme left) who don't belong. The welding tractor tows its own supply unit, on which are mounted the acetylene generator and oxygen manifold, also the beveling machine and other auxiliaries.

Pressure-Welded Pipe Line

Designed primarily to weld railroad rails, the oxy-acetylene pressure welding process has been extended successfully to the construction of natural-gas pipe lines of large diameter. This article gives details.

By ELTON STERRETT

TO ALL intents and purposes, the Tennessee Gas & Transmission Company's trunk gas line is a single 24 in. OD all-welded tube 1,265 miles long. Stretching from near Corpus Christi in Southern Texas to Cornwell, West Va., the big natural-gas trunk line was built entirely from scratch. Thus it was not necessary to incorporate any existing facilities; neither were there prior company policies nor established practices to clash with projected innovations. The engineers designing and laying out the line were therefore given that rarity among big jobs—the chance to design and outfit according to most recent practices.

One of the innovations rating high in results secured was the use of oxy-acetylene pressure welding for joining the 40-ft mill lengths. No screwed or flanged joints at all were used on the line between compressor stations, and these were spaced some 170 miles apart.

Proved Performance Record

More than one third of the line is in Texas, traversing nearly 400 miles of flat coastal plains. It was decided to use the pressure welding process on the initial or downstream part of the line. The choice was made only after a careful investigation had been made into the successful performance of the process on shorter and smaller diameter lines. Special equipment was then fabricated to accommodate most advantageously the large but unusually thin-walled pipe.

Difficulties Encountered

Basically, the pressure-weld system requires simply the holding and heating of abutting ends of two pieces of pipe and means for forcing them together under hydraulic pressure (when the proper temperature has been attained) to form a weld simultaneously around the entire circumference of the joint being made. Much more than this is needed in actual practice, however. Due to the thin

Fig. 2—Clamping the pipe for welding. The abutting pipe ends are being spaced by the spread foreman while the open clamps are waiting to be lowered and clamped around the pipe. The flames—ordinarily not lighted until alignment is completed—were lighted specially for this picture in order to show the equal flame distribution of the heating unit.

walls (¼ in.), most of the time expended per weld went to insure absolute roundness of the pipe and accurate matching of the abutting ends to obtain the full cross-sectional area at and immediately adjacent to the weld.

The 24 in., 40 ft pipe sections were hydraulically expanded within dies at the mill to insure accuracy. The longitudinal seam was resistance welded at the mill. The ends were cut true and then given an 82½ deg bevel at the mill. The finished pipe weighed theoretically 63.413 lb per foot.

Steel Specifications

The chemical specifications for the steel were:

Carbon	0.30% maximum
Manganese	0.95—1.25%
Phosphorus	Not over 0.045%
Sulphur	Not over 0.050%

The minimum physical properties specified were:

Yield point	50,000 psi
Tensile strength	70,000 psi
Hydrostatic test (72% of yield pt)—	940 psi
Random lengths to average	40 ft. or more

The pipe was shipped in open gondolas, and care had to be exercised to prevent end distortion. Any ends found excessively out-of-round on delivery were cut back into the line until a true circle was found. An oxy-acetylene beveling machine was then used to regain the desired slight clearance at the outer edges.

Welding Tractors

The welding crew or "spread" used by each of the three contractors working on this job employed two side-boom tractors (Fig. 1). The first tractor was equipped with wide-faced jaws for lifting and positioning the joint of pipe to be welded to the already completed section of the line. On the second tractor all of the welding equipment was concentrated. Besides the welding head, which was suspended from the side boom, this tractor carried the hydraulic pump powering the various actuating cylinders for spotting, controlling and forcing together the abutting pipe ends. In addition, it carried a cooling water system for: (1) maintaining a flow of fluid into the hollow members of the welding head and (2) insuring circulation to the secondary or auxiliary radiator.

Clamping Head

The twin clamping halves of the welding head were equipped with closely spaced jaw blocks (Fig. 2). These seized the ends of the pipe, holding them tightly, and at the same time forced any egg-shaped pipe-end deformities back into a true, cylindrical end. At the time the new section of pipe was brought to position ahead of the welded line, a check was made of the required clearance around the open joint, and the pipe was blocked to maintain uniform clearance around the entire gap. The gap was closely regulated so as to insure full penetration of the flames across the face of the metal to be joined and was kept at a minimum to reduce the lateral motion required in welding.

By means of separately operated lifting cylinders connected to the two clamping heads, the two pipe ends

Fig. 3 — The welding tractor with the head in place over the joint. The welder at left is manipulating the controls to bring the two thin circles of steel into proper alignment and with the right clearance for the welding flames. The hoses supply oxygen, acetylene, cooling water to the clamping jaws and hydraulic leads to the various actuating cylinders.

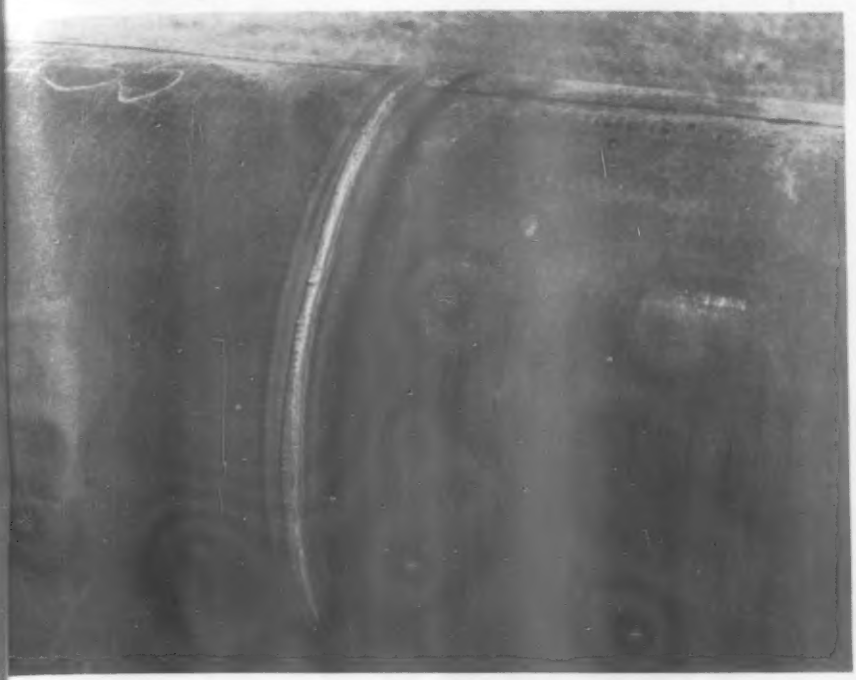


Fig. 4—Close-up of a pressure-welded circumferential seam. The corrugated face shows the extent of heat penetration, the raised section the serrated marking of the clamping jaws. Most of the flash is outside the pipe, the inner ridge being smooth and rounded.

were shifted and adjusted until they were accurately aligned in full view of the operator (Fig. 3). The flames were not lighted until the adjustment was satisfactory.

The Heating Assembly

Supported on slides carried by the welding head, the heating ring (shown in Fig. 2) is cored to provide separate passages or channels for oxygen and acetylene. Around the inside of this ring are located the separate heating tips, which have clear access to the entire circumference of the area to be heated. The tips vary with the diameter of the pipe to be welded. For this 24 in. line, the heating assembly consisted of 365 jets, arranged so as to give a continuous sheet of flame within two inches of the supporting ring. The heating ring is adjustable on its supporting slides and can be given an oscillating or to-and-fro motion as the pipe ends are being heated. The heat can thus be distributed as appears necessary to the two weldors supervising the job.

The movable head or clamping section of the unit is supported on heavy cylindrical guides. These are closely fitted so that when hydraulic power is admitted to the closing rams the free section of pipe will be carried ahead in a direction exactly parallel to its axis. Thus the two heated surfaces can be joined evenly over the more than 85 inches of weld circumference. As soon as the ram motion is made, the heat is cut off; by the time the clamping heads are unlocked and the device opened for lifting clear of the pipe, the weld has cooled to where it is the equal of or superior to the remainder of the pipe in rigidity, tensile strength and density.

As previously stated, the pipe walls were beveled so as to leave a gap which widened outwardly between abutting pipe ends. To insure good flame penetration, the shoulder or ring of metal formed within the pipe was less in both height and area than the thickened section on the outside. The inwardly projecting metal is smooth, free from jagged flash or icicles which might later cause trouble with pipe-line scrapers. The outwardly forced metal shows a toothed or serrated appearance (Fig. 4) due to contact with the corrugated face of the clamping dies or jaws.

Preweld Grinding

The only preliminary treatment given to the pipe prior to welding—apart from the removal of damaged ends—was to go over the mill-beveled surface with an air- or electric-powered grinder. This grinder (Fig. 5) was mounted on a spindle which automatically centered within the pipe parallel to its axis. The abrasive disc was automatically set in the plane of the bevel when the unit was socketed on the supporting shaft. The operator merely revolved the unit so that the disc could cover the entire welding face, repeating the swing to remove heavier rust spots.

An average day's work done by one of these welding "spreads" included 100 or more welds, representing a line footage of 4,000 and up. The footage figure, however, varied with the amount of pipe lost when damaged ends were cut out.

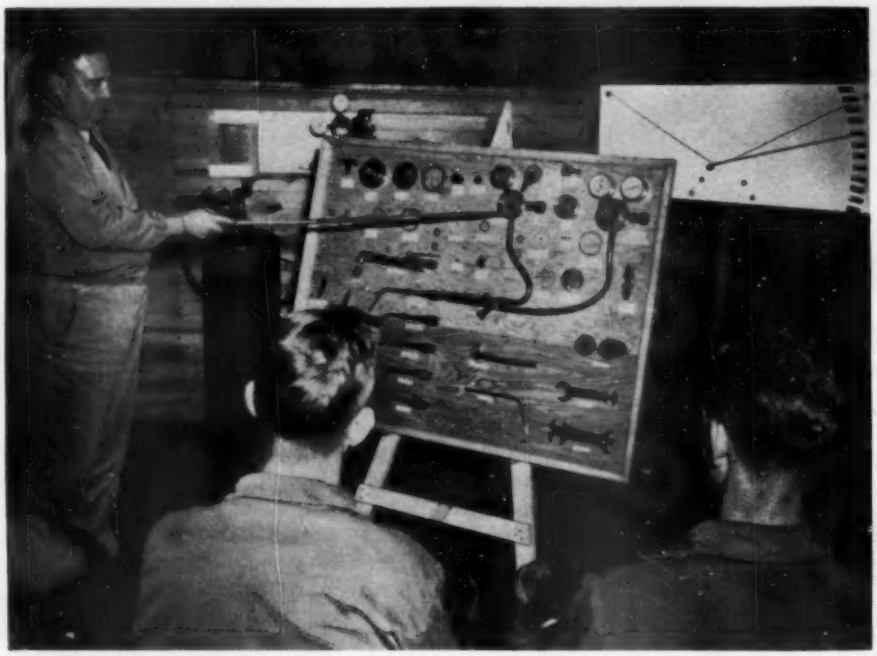
Fig. 5—This electrically driven grinder is mounted on a support centered and aligned within the pipe, and the grinding disc automatically holds the proper bevel while being rotated around the axis. The operator is making a quick pass over the beveled end of the pipe before it is moved into position for pressure welding.

Training QM Weldors

G.I.'s who attend the blacksmith and welding school of the Army Service Forces Training Center, Camp Lee, Va., learn how to weld by using the most modern equipment.

By **SGT. CHARLES B. DUNHAM**

SOME of the most modern and up-to-date equipment known to the welding industry is now in use at the Quartermaster blacksmith and welding school of the Army Service Forces Training Center, Camp Lee, Va., aiding in the training of skilled QM weldors to take their place in the Army's vast network of service and supply throughout the world.



U. S. Army Photo

A classroom scene in the Quartermaster blacksmith and welding school of Camp Lee's Army Service Forces Training Center. Instructor George D. Foulkrod, of Petersburg, Va., is pointing to a diaphragm used to regulate the working pressure of an oxy-acetylene welding torch. The board contains a complete welding and cutting outfit.

Big Acetylene Generators

As an example of the scope of this enterprise, two 500 lb acetylene generators have been installed at the welding school for the generation of its own acetylene gas. This is the largest size of acetylene generator known to the industry, and there are not too many of them in existence.

The construction of the generator system was accomplished entirely by soldier labor, and the amount of money spent in its construction was saved during the first eight months of operation, since carbide could be bought in larger quantities at a saving. Also, the gas leakage and time wasted in hooking up the separate acetylene cylinders were eliminated by the central system.

The gas, generated by combining calcium carbide and water, is piped underground into the welding shop from across the street. In the generator building is also located an oxygen manifold system of 22 cylinders, from which oxygen is likewise piped underground to the shop. The acetylene and oxygen are used in the 48 stations of the shop, where complete welding outfits —everything but the cylinders—are set up.

Army Instructors

The idea for the generator system was that of Thomas H. Shinault, head civilian instructor at the shop. He is planning to secure an oxygen generator to go with the acetylene one. A native of Richmond, Va., Mr. Shinault has been welding for 30 years.

Another veteran weldor is Lieutenant Charles Unger, officer in charge of the shop. He worked with a large electrical manufacturing company in Pittsburgh prior to entering the Army. As an enlisted man, he was at the blacksmith and welding school at Camp Lee from February to June, 1931. Following service in Iceland,

U. S. Army Photo

Removing lime residue from one of the new 500 lb acetylene generators. Thomas H. Shinault, of Richmond, Va., head civilian instructor, is pointing at the controls.

England and North Africa with the Transportation Corps, he was transferred back to Camp Lee.

Training is provided at the Camp Lee school in blacksmithing, oxy-acetylene welding and arc welding. Instruction is given in welding both ferrous and non-ferrous metals. All welders receive two weeks' schooling in blacksmithing, four weeks in oxy-acetylene welding and two weeks in theoretical arc welding. Blacksmiths who show efficiency after six weeks are given two more weeks of welding instruction.

Postgraduate Activities

The school's training program prepares Quartermaster soldiers for work in QM blacksmith and welding activities in base depots and repair shops overseas, as well as in this country. The graduates do welding work on heavy equipment in the field, including salvage and reclamation work on tanks, heavy guns and automotive equipment. They repair mobile laundry, fumigation, bath and refrigeration equipment in the field—also field ovens, steel cots and bed frames, sewing machines, shoe-repair machines, dishwashing machines and cooking utensils.

Besides its training functions, the school does a great deal of actual production. Since 1941 it has performed 2,503 jobs for various elements of the training center. The production jobs included: the repair and welding of chains, straightening and welding of truck bumpers and frames, forging of all types of hand tools, production of all kinds of special tongs, welding of trucks' axles, housings, exhausts and intake manifolds, repair of Engineer and Post laundry equipment and the manufacture of all types of tables, benches, brackets and training stands.

After They Go

The instructors of the school have developed a system whereby they keep in touch with their graduates after they leave Camp Lee. Each man is given a postcard printed with the return address of the school. On the back are blank spaces to be filled in to tell where the graduate is, what type of unit he is with, what specific type of work he is doing. There is also room on the card for writing down suggestions for improving the course, based on the trainee's postgraduate observations and experiences. The plan has been in operation several months, and cards have been returned from the Southwest Pacific, Australia, England, North Africa, etc.

U. S. Army Photo

Quartermaster trainees learn all about welding at Camp Lee's blacksmith and welding school. Above are students working at three of the school's 48 oxy-acetylene welding stations.

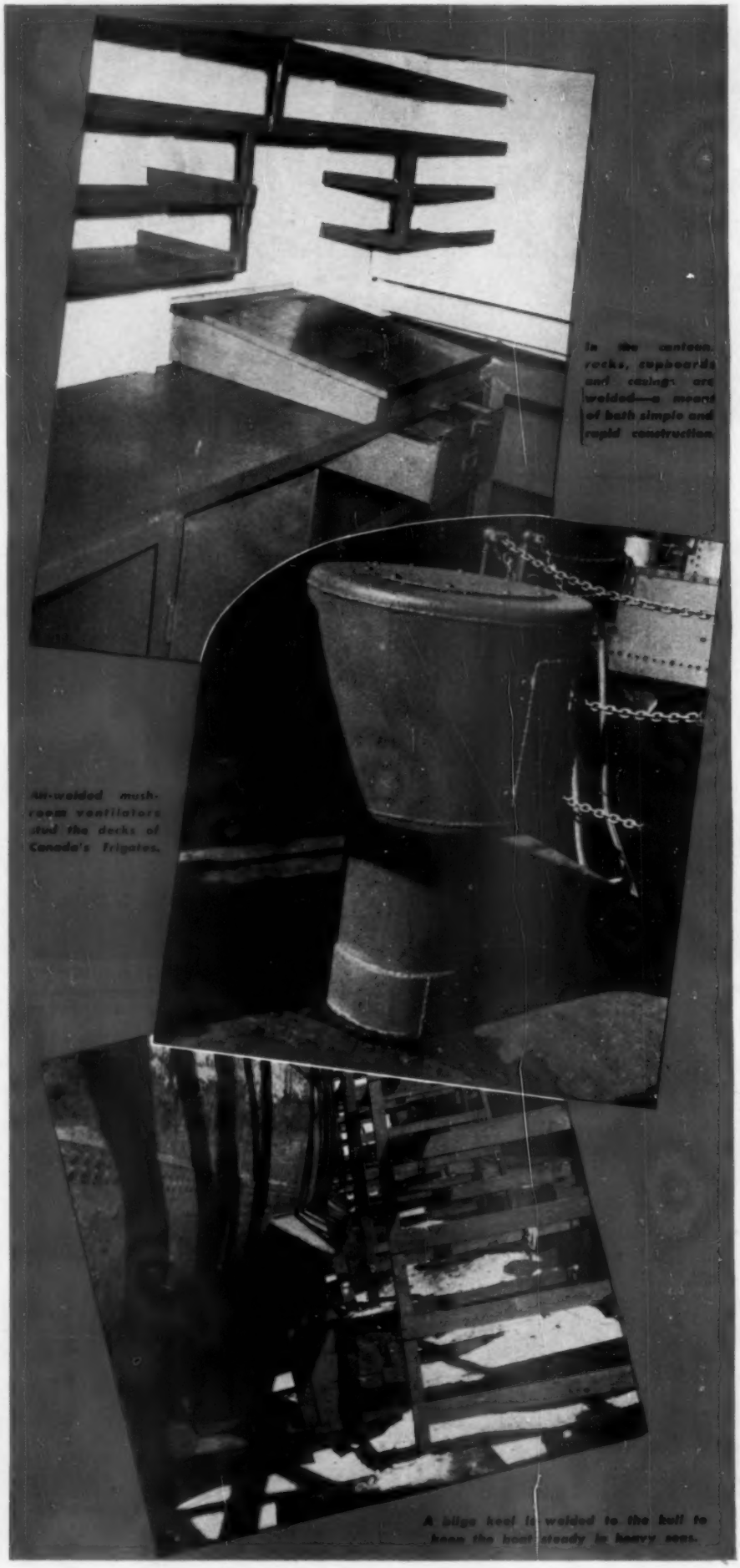
U. S. Army Photo

Charging a bank of oxygen cylinders on the manifold line. The manifold system comprises 22 cylinders, from which oxygen is piped underground to the shop's work stations.

U. S. Army Photo

Charging with calcium carbide one of the two 500 lb generators which supply acetylene gas for use by the blacksmith and welding school.

Welding Ca



In the canteen, racks, cupboards and ceilings are welded—a record of both simple and rapid construction.

All-welded mushroom ventilators stud the decks of Canada's Frigates.

A bilge keel is welded to the hull to keep the boat steady in heavy seas.

CANADA'S navy, destined to patrol hundreds of miles of coastline in two oceans, escort countless convoys and play important roles in the invasions of Africa and Europe, consisted of only 15 ships at the outbreak of the current conflict. Canada's shipyards, however, answering the urgent call of their government, have built a navy that now numbers over 700 units.

Fast Growing Industry

These ships, along with hundreds of cargo boats, were turned out by less than two dozen major shipyards—a production feat of no mean proportions. Furthermore, Canadian shipyards were engaged chiefly in repair work prior to the war and thus had to expand their facilities and personnel tremendously before they were able to undertake the building program.

It is estimated that this industry (including subcontracors) now employs roughly 100,000 workers, a good percentage of Canada's total population of approximately 11,000,000. On this basis, Canada's per capita production of ships is equal to that of the United States, the accredited world leader.

Corvettes and Frigates

From the very outset of the war Canada's greatest need was for escort vessels which could carry out off-shore patrols and also escort the steady stream of convoys that carry vital food and war supplies from North America to Britain. The first ship designed for this double duty was the Corvette. These squat, beamy little boats were relatively easy to build and could be turned out in a comparatively short time. On the debit side they were slow and lightly armed, which put them at a disadvantage in combat with late-model submarines.

As the navy expanded and its immediate needs became less urgent, the demand swung from quantity to quality. The result was the birth of the Frigate. These boats were named in a romantic throwback to the days of Nelson, when sailing vessels of that name were the intermediate class between Corvettes and ships-of-the-line. The new ship is more than 100 feet longer than its predecessor, the Corvette.

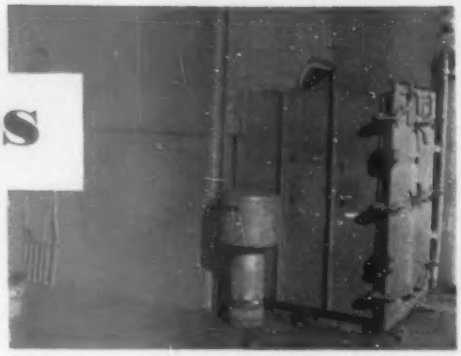
In its function as an anti-submarine convoy escort ship, the Frigate is often

Canada's New Frigates

Despite British influence favoring traditional riveted construction, Canadian shipyards are turning more and more to welding. The trend is especially noticeable in the case of the Frigate—an old name for a new ship.

By DONN BORING

G. D. Peters & Co. of Canada, Ltd.



Shelters and lockers are of welded construction. Built of air-hardenable steel, they afford the maximum protection against enemy action.

referred to as a super-Corvette—bigger, faster, more powerfully armed, with longer cruising range and better accommodation. In direct comparison with the Corvette, its cost is one and a half million as opposed to one million. It has twice the gunpower, and carries many more depth charges. Its depth-charge throwers and rails are the most efficient in the navy. It is 310 feet long as compared to 190 feet for the Corvette. Although not as narrow nor as fast as a destroyer, the Frigate is definitely "navy" type and has much finer lines than the trawlerlike Corvette. Twin-engined, twin-screw power gives it greater speed and range than the singly powered Corvette.

Seven to Eight Month Schedule

Skill and craftsmanship are essential components of a Frigate. Construction usually averages seven to eight months from keel-laying to trial runs, and it requires planning and labor on the part of hundreds of workers to maintain this schedule. Of vital importance to this urgent schedule is the expanded use of welding in keels, bulkheads, deck plates, engine beds, vertical butts on shell plating, ventilators, hatches, breakwaters, masts as well as in hundreds of obscure locations where in itself a weld may be unimportant but in the final analysis is essential to the speedy and secure construction of these ships.

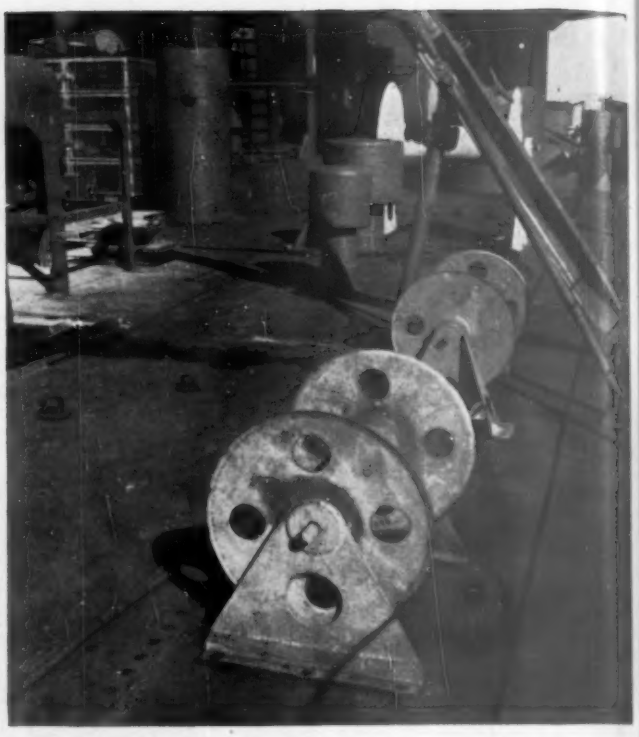
Welding vs. Riveting

On the whole the use of welding in Canadian shipyards is on a smaller scale than in United States shipyards, and this can be attributed largely to British influence. Since time immemorial, shipbuilding has been a major industry in Great Britain, and from the earliest days of steel-plate construction (when welding was unknown) British yards have used riveting as the principal means of fabrication. It is quite natural, therefore, because of the predominance of riveting equipment and skilled operators, that they

Breakwaters take a severe beating in rough weather. All-welded construction provides maximum structural strength.

Structures that must be strong and dependable, i.e., lifeboat davits, are all-welded and welded also to the deck.

All-welded escape hatch insures a watertight, airtight boiler room.



Life-rope reels are welded throughout as well as welded to the deck.

should adhere to this method of construction. Since Canada has always carried on a very active trade with England, ships from Britain called frequently at Canadian yards before the war when in need of repairs. For this reason our yards had to have equipment and personnel to deal with riveted ships. When war broke out and work was started on a cargo-boat program, the plans that were followed were for the British North Sands type of boat, which called for a majority of riveted construction.

On the other hand, Canadian builders have also been greatly aware of the American trend to all-welded structures. The result of the combined influences is a compromise between British and American methods. This is clearly reflected in the construction of Frigates. Basically, these ships are riveted so far as their main structural elements are concerned, but welding is used wherever it is deemed advisable.

Typical Applications

It is probably safe to say that you couldn't stand anywhere on a Frigate without being in sight of welding. It appears in such varied applications as passageway casings, ventilators, masts, lifeboat rope reels, lockers, ladders, davits, hatches, splinter boxes, shell racks, crow's nest and other places too numerous to mention. Wherever welding is used, it is used to good purpose; namely, to impart greater strength, to speed an operation or to join metal where no other method would apply.

One point where strength is very important is in the breakwaters, which take a terrific beating in a North Atlantic gale. These structures are all-welded, reinforced with welded stiffeners and finally welded to the deck. The bilge or rolling keel also must stand terrific strain in its function of keeping the boat steady in heavy seas. This part, too, is all-welded and welded to the hull.

Watertight Doors

Welding fulfills another requirement in the construction of watertight doors, being used in the frames to provide leakproof joints. Miscellaneous applications include the welding of strips of checker plate to the deck to guard against slipping, all-welded mushroom ventilators which stud the decks, all-welded eddy plates that protect glands and stop leaks around propeller shafts, shell racks that are welded to the bulwarks, and heavy fairlead castings that are welded to the deck with multiple-pass welding.

Welded porthole "eyebrows" keep water out.

Sick Bay and Crew's Quarters

Below decks, welding is used in all kinds of structural work. For example, the Frigate's modern and efficient sick bay is practically welded throughout. Welding is employed in casings, fittings and accessories. In the crew's quarters, in washrooms, the canteen, etc., welding is extensively used in racks, lockers, benches and shelves.

The applications that have been mentioned represent only a handful of the hundreds of welds located throughout the length and breadth of these twentieth-century Frigates. None of these jobs, however, involve any special techniques or considerations. The electrodes used are those recommended and approved for marine work, particularly AWS Class E-6010, an all-position electrode which provides maximum penetration, high strength and ductility. The fact that it can be used in all positions is an important consideration in this kind of work.

Though the rapid progress of the welding trade may make these applications commonplace, it cannot rob them of their significance nor minimize the importance of their contribution toward speeding Canada's Frigates into battle.

Emergency in the Lead District

When a wire cable cuts new grooves in a hoist sheave, what can be done to put it back in the old channel? Answer: use arc welding.

By **R. A. BRADY**

Fig. 1—At top is the grooved surface over which the cable should operate, below the surface cut by the cable when a faulty alignment developed. To see what can happen if a repair is not made, look at Fig. 2.

Fig. 2—This section of the sheave was worn or cut entirely through by the abrading cable. It was satisfactorily repaired by arc welding, using an electrode with a cast-iron core.

ARC WELDING is proving itself indispensable to emergency repair work in the lead and zinc field near Picher, Okla. Many prewar conventional methods have been done away with because of the time element and the difficulty in obtaining needed replacements parts. Welding has been rushed into service to fill the gap. As an example, sheave grooves are being built up with welding metal to give nearly as much service as new replacements.

The lead and zinc ore is hauled from the heading to the bottom of the shaft, from which point it is hoisted by cable to the top. The ore is hoisted in "cans," each one containing several tons, which are raised and lowered by means of a ⅞ or 1 in. cable operating over the cast-iron sheave.

Sheave Alignment

Proper alignment of the sheave is difficult to maintain because of its constant usage and the shock loads that are placed upon it. Furthermore, the only lubrication for the grooved tread is provided by grease from the cable itself. A faulty alignment, however, causes the cable to run against the sides and so start the cutting of a new groove. This abrasive wear soon destroys the sides and center of the former groove.

The top section of Fig. 1 shows the grooved surface over which the cable operates when the sheave has proper alignment. The lower section shows the surface cut by the cable when a faulty alignment develops. The picture, it should be noted, was taken looking directly down into the grooved surface of the wheel.

In Fig. 2, the sheave was cut entirely through by the cable, making an immediate repair necessary.

One solution to the problem is to have a new sheave cast in the foundry. But foundries are busy now, and even if they were eager for work, it takes plenty of time to make a casting of an object as bulky as a sheave and to machine and deliver it. The only practicable alternative is to repair the sheave by welding.

The welded repair may be made either on or off of the line shaft. In the latter case, the shaft must be dismantled and the sheave removed. To weld the sheave without removing it, a welding platform is swung from the line shaft.

Welding Procedure

The cracks in the sheave are first scarfed and ground. The area to be welded is then preheated by torch at a temperature of approximately 300 F. Welding is done with an electrode having a cast-iron core and a special coating. The electrode manufacturer's instructions are strictly followed. Continuous welding is used; that is the first layer of metal is not allowed to cool before the next one is deposited. Hence there is no slag to remove.

Each pass is made by weaving the bead until the entire surface has been covered. Special care must be taken to secure good penetration of the weld metal into the surface of the sheave. After completion of the weld, it is necessary to allow sufficient time for proper cooling. The sheave is then revolved slowly on the line shaft and smoothed off by means of a portable grinder.

We have found that preformed hoist cable is preferable to non-preformed because it more readily trains itself to the repaired sheave. Also, the pre-formed cable lasts considerably longer than the non-preformed under the same stress.

★ PRODUCTION

Arc-Welded Power Trucks

Fig. 1—Stacking loads to ceiling height in warehouses is only one of the several functions of Elwell-Parker industrial trucks.

To perform satisfactorily the various jobs of lifting, hauling, stacking, industrial lift trucks must combine mobility of a destroyer with a battleship's stamina. Welding enables them to stand up under rugged service.

By **C. E. COCHRAN**

Director of Engineering, The Elwell-Parker Electric Co.

WELDING procedures used in the fabrication of body frames for Elwell-Parker industrial power trucks are necessarily procedures which guarantee a dependable and rugged type of construction. These trucks are built to make quick, short hauls of either materials in process or finished products—to carry loads ranging from a few hundred pounds up to 30 tons—to stack loads weighing a ton or more to ceiling height in warehouses and storerooms (Fig. 1). Because of the variety of floor conditions under which they operate, the trucks are subject to considerable vibration during travel. In order to do their various jobs and remain in service, power trucks must have the mobility of a destroyer combined with the stamina of a battleship.

First Requisite: Durability

Arc welding is used to accomplish the above design objectives rather than to reduce either weight or cost. Some advantage also accrues from the economical distribution of material inherent in welded construction. The fact that there is no excess weight in the upper portion of the body helps to keep the center of gravity low, increasing the stability of the truck when loaded. Since it is common practice to weight some types of bodies with lead, it can be readily seen that there is no temptation to go to extremes in weight saving. Likewise, the cost consideration is secondary to the necessity of producing a rigid, solid, durable frame which will not shake apart under the most severe conditions of loading, vibration and impact.

One power truck multiplies the productivity of the individual worker from five to ten times. Throughout the war these trucks have functioned to furnish critically needed transportation in steel plants, light metals plants, round houses, aircraft plants, foundries and munitions plants; they deliver war materials to transport planes, freight cars and steamships;

Fig. 2—Body frame of Elwell-Parker F-25 fork truck being assembled and tack welded in the fit-up shop.

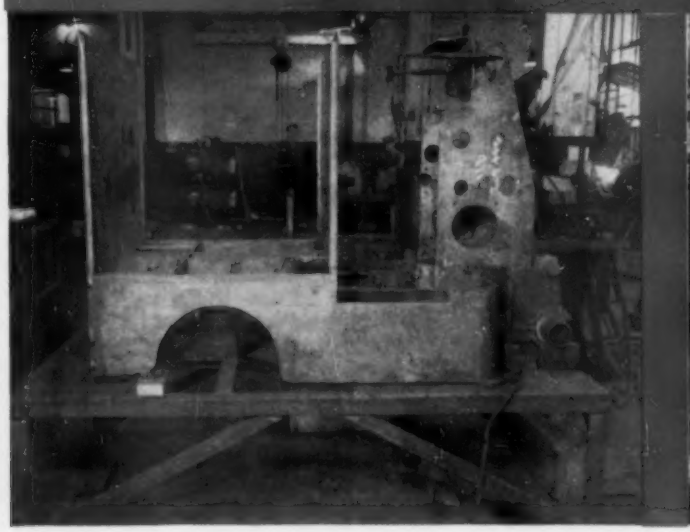


Fig. 3—A straight-line flame-cutting machine puts a taper on a heavy-duty fork. The cut in this case is six inches deep.

Fig. 3—Battery compartment after the front plate has been welded in place. The intermittent welds are staggered with similar welds on the reverse side.

they handle vast tonnages of supplies and ammunitions in warehouses and terminals. The fact that they have been performing these kinds of services with zero weld failures seems to justify the emphasis we put on sound welding.

Flexible Production

Welding procedures developed at the Elwell-Parker plant were measured by experience and by performance of the finished product to determine the overall economy. If some of the modern refinements of welding practice in mass production welding appear to be missing, it is because the very large number of changes in design details makes it uneconomical to adopt them. Theoretically, the number of standard designs has been reduced by war limitations from more than two hundred to less than twenty; yet the flexibility of welded construction makes it possible for us to incorporate special details in practically every truck.

With output limited and demand high, our field representatives have shifted their emphasis from conventional selling to a transportation advisory service; they have worked with our engineering department on every order to adapt the limited number of standard designs to a very wide range of requirements. This cannot be done successfully on a mass-production basis. Elwell-Parker therefore considers it necessary to fabricate body frames in its own plant, under its own direction, just as it makes the motors which drive these trucks.

Flame-Cutting and Assembly

Fig. 2 shows the body frame of an Elwell-Parker F-23 fork truck undergoing assembly in the fit-up shop. A standard assembly for this model contains 37 parts of many different sizes and shapes. Two of these parts are steel bushings machined from bar stock; two more are small steel castings (frame connectors), and the rest are formed from low-carbon steel plates from $\frac{1}{8}$ to $\frac{5}{8}$ in. thick.

Some parts are shear cut; some are cut with machine cutting torches and some are flame-cut by hand. Both straight-line cutting (Fig. 3) and shape-cutting (Fig. 4) are used. Most parts of more than 5/16 in. thickness are made by subcontractors to order. The designs call for very few beveled edges, and these are easily produced with the flame-cutting machines.

The fit-up of a unit assembly is a one-man job. The parts are assembled and tacked in place on fit-up tables (Fig. 2). Pieces of band and bar stock are tack welded into position to hold the heavier components of the body in alignment until welding is completed. By assigning an entire fit-up to one man, the responsibility of every detail is very definitely fixed,

Fig. 4—Irregular shapes are quickly cut from plate or bar stock with a pantograph-type flame-cutting machine.

Fig. 5—Tacked assembly as delivered to one of the welding booths. The narrow bracing strips will be removed after welding is completed.

Fig. 7—The cast-steel frame connectors shown at lower right are welded to the frame body from both sides.

and, furthermore, the weldor who does this job acquires experience with every type of weld involved.

Finish Welding

When the tacked assembly is moved to the welding department (Fig. 5), it again becomes the responsibility of one man to do the complete welding job. The weldors are assigned to this important work only after a long period of plant training in our welding requirements, and after they have demonstrated an aptitude for job responsibility on the work itself. The first inspection of every unit is made by the man who does the welding, and it is very seldom indeed that later inspections do not confirm the first one.

All strength welds are of course continuous, and wherever practicable they are welded from both sides. In cases where single continuous welds would ordinarily be specified, staggered intermittent welds are usually made from both sides (Fig. 6) to provide an extra margin of safety without materially increasing the amount of welding or the cost. A ¼ in. electrode, with plenty of heat, in the hands of a skillful operator gets ample weld penetration and produces a fillet of good contour. A slight offset on edge welds provides enough groove to guide the operator in making a straight, neat weld that may be easily ground to give a smooth, workmanlike appearance.

Avoiding Arc Blow

D-c welding machines are used throughout the shop. Some arc blow is encountered on inside corner welds, as in the inside welding on the counterweight lead pockets underneath the rear of the floor plate (Fig. 6). Our operators, however, soon become skillful at positioning the ground connection so as to overcome the effects of arc blow. No general rule can be set up for this adjustment because some electrodes are subject to arc blow when depositing metal toward the ground and others when depositing away from the ground.

An important factor in the control of weld quality is the selection of the correct electrode for each type of weld. Three grades of electrodes take care of practically all of the requirements of body frame assembly. An E-6010 class (all-position) is used on seams to get a fast deposit and a complete fill without excessive build-up. An E-6020 electrode (downhand) is used for fillets because it flows fast and leaves a smooth, easily cleaned deposit. An E-6012 electrode (all position, straight polarity) is the operator's choice when he encounters an unsatisfactory fit-up condition.

Positioning

Although these assemblies are bulky, they are not too heavy to be turned with chain hoists in order to make all welds in the flat position, and there is plenty of room for the operator to work comfortably. The operator completes as much welding as possible, including such fittings as are shown in Figs. 7 and 8, before he welds the floor plate of the battery compartment in place (Fig. 6). It is always necessary to be prepared for minor changes in design detail in order to meet the special requirements of customers, and this system of floor assembly is judged more workable than the construction of elaborate jigs. Such jigs would either require modification very frequently, or they would have to be built in such large numbers as to cause an excessive storage and handling cost.

Fig. 9 shows a completed body frame ready for finishing. The major

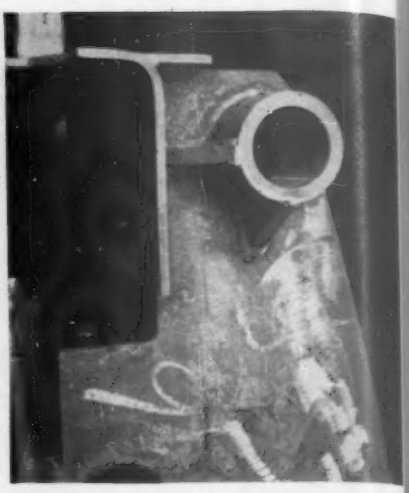


Fig. 8—Detail of welding on steel bushings. These are machined from bar stock.

portion of the welding done at the Elwell-Parker plant is on such body frames as this. However, the process is invaluable for the fabrication of many smaller assemblies and of special attachments which are constantly being developed to solve special material-handling problems. With a crew of skillful and versatile weldors it takes very little time to cut out the parts and fabricate these special jobs. Equally important, the quality of workmanship will be the same as that which characterizes the fabrication of the body frames.

In conclusion, welded construction has proved to be highly satisfactory in the manufacture of Elwell-Parker industrial power trucks and cranes. Credit for its success is largely due to the development of procedures which aim at quality and to the maintenance of a welding personnel with extraordinary aptitude for job responsibility.

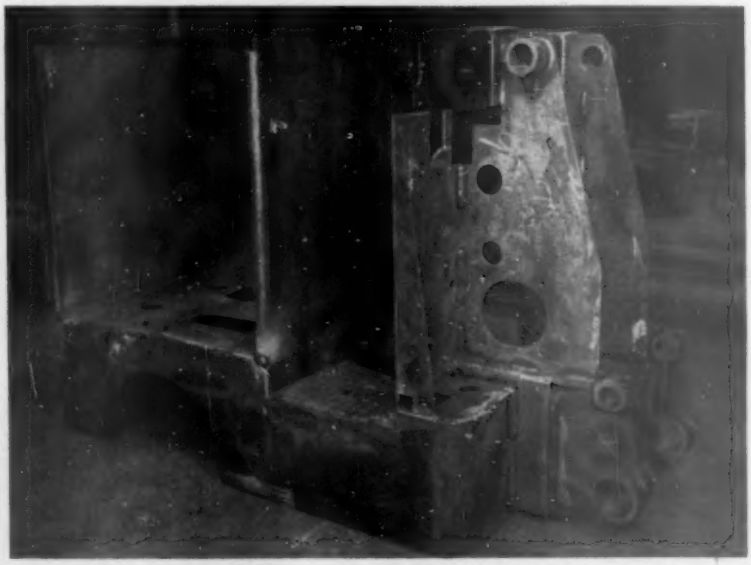


Fig. 9—Completed body frame of an F-23 truck ready for finishing and assembling.

Improved Spot-Welding Control

The weld comparer makes use of the principle of the photoelectric cell to assure a continuous check of weld consistency. When this device is at work, welds of inferior quality can no longer sneak by unnoticed.

By **HAROLD J. HAGUE**
Electronic Engineer, Westinghouse Electric & Manufacturing Co.

PHOTOELECTRIC equipment has many applications to resistance welding. An instrument called a weld comparer, for instance, warns the operator with a gong if the welder input is not within allowable limits for consistent welds of high quality.

On Vehicles of Transport

Spot welding is today being widely used on vehicles of such varied nature as aircraft, rail cars, trucks, trailers, buses and other vehicles that are playing an important part in World War II. Since this type of transportation equipment is subjected to stresses and strains not normally present in the majority of welded structures, continuous checking of weld quality is necessary in order to insure maximum safety and reliability. The weld comparer is designed to make it easy for the operator to compare the welds being made by his machine so that inferior welds will not get by unnoticed.

Basically, the device consists of:

1. Comparer instrument (ballistic ammeter)
2. Phototube housing, light source and phototroller
3. Single-stroke gong
4. Current transformer
5. Range switch and sensitivity control.

Circuit Reflects Light Changes

The operator first selects the proper range over which he expects to operate his machine. Since the ammeter is connected in the circuit, as shown in Fig. 1, every time the welder is used the ammeter's pointer will swing in proportion to the current flowing through the welding transformer primary. The pointer has a mirror mounted on its side, facing the rear near the meter scale. An aperture is provided in the meter dial about mid-scale, through which a light source projects a beam of light. Both the mirror and the light source are shown in Fig. 2. The arrangement is such that when the mirror is

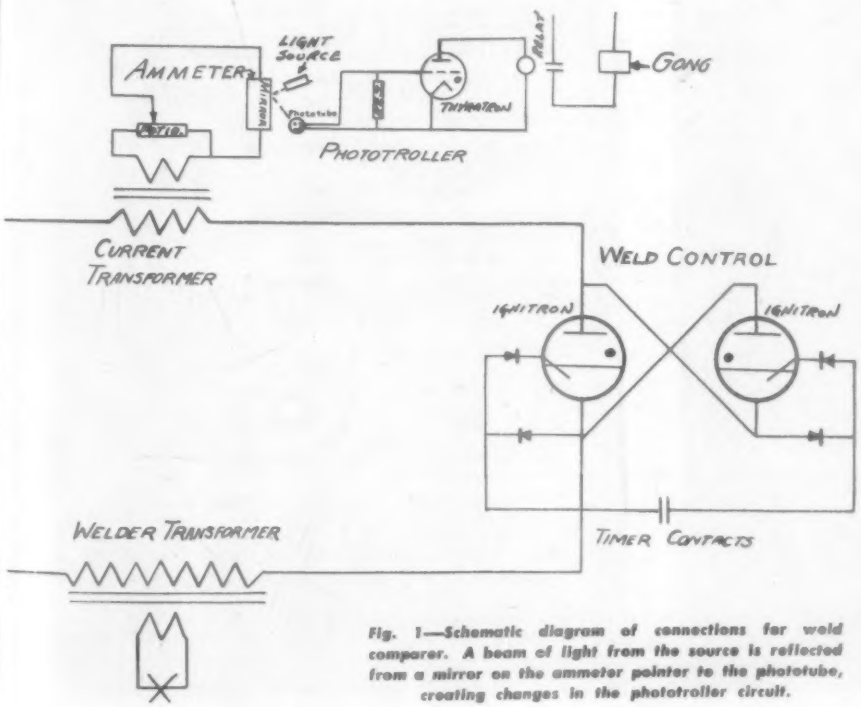


Fig. 1—Schematic diagram of connections for weld comparer. A beam of light from the source is reflected from a mirror on the ammeter pointer to the phototube, creating changes in the phototroller circuit.

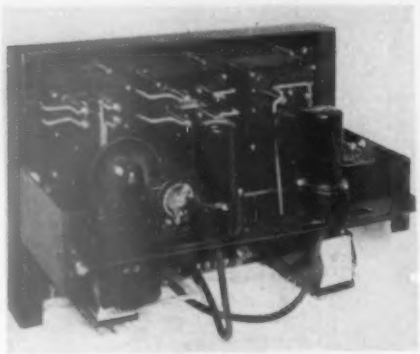


Fig. 2—Rear view of spot-welder instrument panel showing installation of the gong, light source and phototube. The phototroller unit is separately mounted.

in front of the aperture, the light will be reflected to the phototube. The impulse of the light on the phototube changes the balance of the circuit, resulting in a small current to the phototroller. The latter then amplifies the current to a value sufficient to actuate the single-stroke gong.

Current Regulation

When the correct value of current is flowing, the ammeter pointer swings to the center position of the meter. The light then reflected from the mirror to the phototube will cause the gong to sound once. One stroke, therefore, signifies correct regulation.

When the welding current is below the lower limit, the gong will not operate. On the other hand, if the current is above the maximum limit, the pointer will swing past the aperture both on the way up and on the way back, thus causing the gong to sound twice.

After the operator has determined the correct value of time and current for the weld, the setting is left unchanged for duplicate welds. As long as the single stroke of the gong is heard, each weld made will be of the same consistent quality. But two strokes or silence warns the operator to look out for trouble.

It is not difficult to adapt the above scheme to other industries. For example, by replacing the ammeter in the above arrangement with a weighing scale, it is possible to use it in food markets to indicate correct weight. It can also be installed in a shipping room to indicate to the loader when a truck has reached its load limit. These applications, however, are taking us out of the welding field.

Fabrication Cost vs. Width*

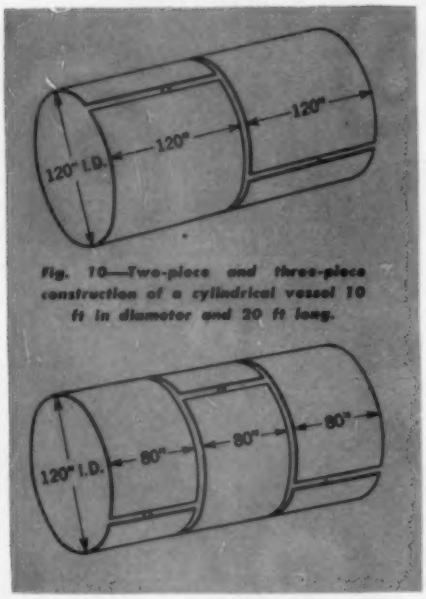


Fig. 10—Two-piece and three-piece construction of a cylindrical vessel 10 ft in diameter and 20 ft long.

Fig. 11—The bars in each group below compare the fabrication costs for the number of courses and plate widths given by the white figures. Shell lengths range from 18 to 44 in. inclusive. The shell is made of 1 in. gauge plate, 120 in. ID, and the cost of a circumferential weld is taken as $11.66 per ft (U-68 construction). The stated costs include the extra fabrication costs resulting from the use of more than the minimum number of courses as well as width extras and overweight allowances for wide plates.

★ Part Two—To build the shell of a pressure vessel, which is more economical: a two-piece fabrication of wide plates or a three-piece or four-piece fabrication of narrower plates? The answer is given here.

By **DR. W. G. THEISINGER**

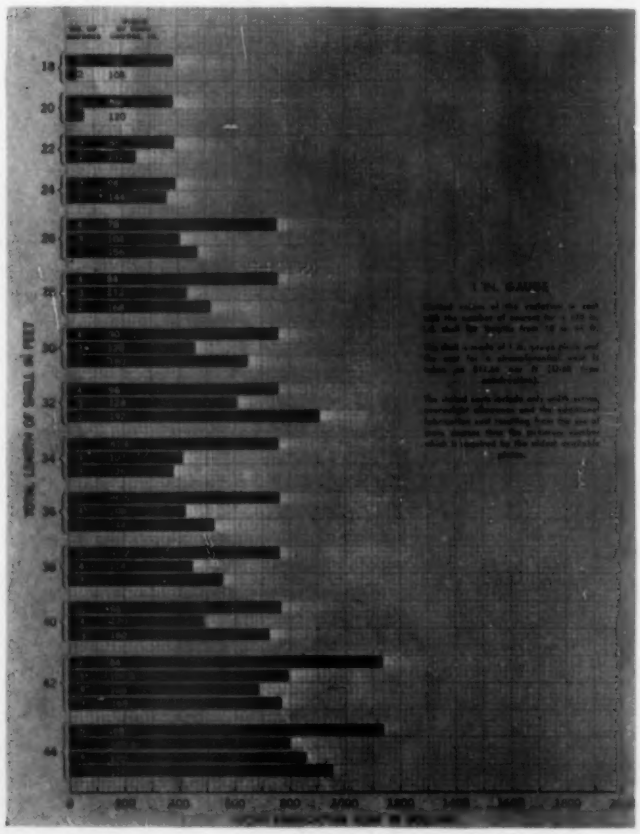
Assistant to Vice-President, Lukens Steel Co.

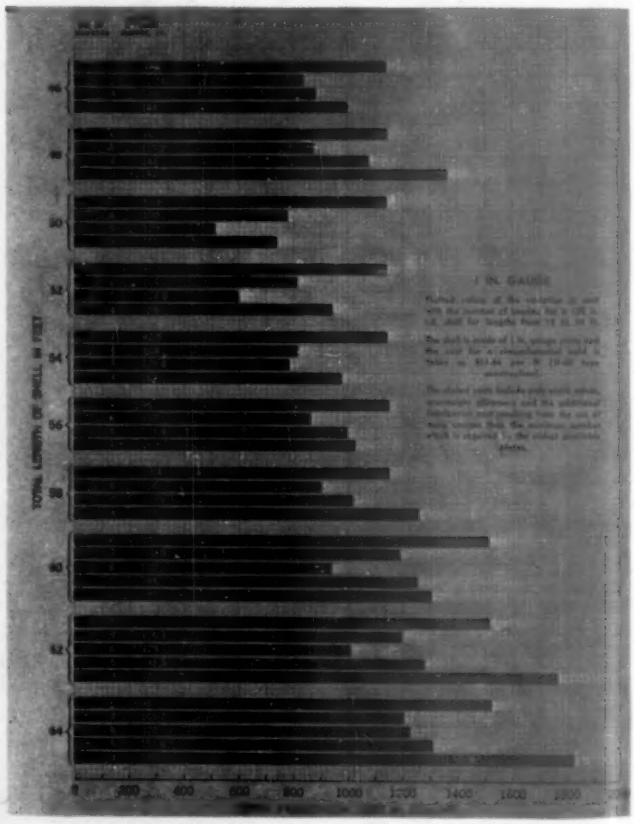
Last month Mr. Theisinger discussed the fabrication of boilers and pressure vessels of U-68 class construction and showed that one-piece fabrication is generally more economical unless very wide plates are involved (over 185 in. for a 1 in. thick plate, for example). He presented tables and charts by means of which the "width extra" charge, quoted by the mills in costs per 100 lb, can be readily compared with fabrication costs expressed in linear feet of seam. This month's installment takes up the more complicated multiple-course construction necessary for large vessels and tells how substantial savings in money and man-power may be effected—THE EDITORS

LET US now consider a cylindrical vessel having a length greater than the widest plate which can be rolled; namely, 195 in. In this case, the length of the plate as rolled will form the circumference of the vessel, while the width of the plate will become part of the length of the shell. For example, the diameter may be 10 ft and the length 18 to 26 ft. Two-piece and three-piece construc-

*Abstract of a paper, "Fabrication Costs of Boilers, Tanks and Pressure Vessels as affected by Plate Widths," presented at the annual meeting of the American Society of Mechanical Engineers, New York City, Nov. 27 to Dec. 1, 1944.

Fig. 12—This chart is a continuation of Fig. 11 for shell lengths of 46 to 64 ft inclusive. As in Fig. 11, the shell is made of 1 in. gauge plate, 120 in. ID.





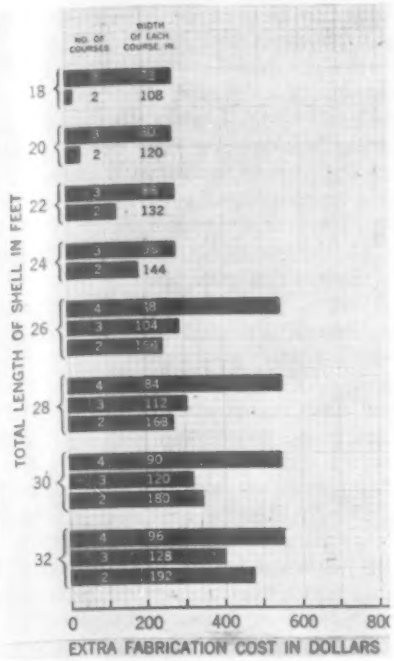


Fig. 13—Cost variations for a shell of ½ in. plate, 120 in. ID, as the length increases from 18 to 32 ft. The cost for a circumferential weld is taken as $8.51 per ft (U-68 construction).

tions of such a vessel are shown in Fig. 10. With three-piece construction, an additional circumferential seam has to be fabricated; the additional fabricating cost is shown in Fig. 11.

Wide Plates Cheaper

A drum 20 ft long, 120 in. ID, may be made either of two courses each 120 in. wide or of three courses each 80 in. wide, as shown in Fig. 10. The 120 in. plates save the fabricating cost of one seam but cost a total width extra for the two plates of $59.30. With three 80 in. plates, 1 in. thick, the cost of making the additional circumferential seam is $11.66 per ft or a total of $380.93. (All figures used include normal overweight allowances, metal and width extras involved in the overweight.) The wide-plate construction thus saves the difference between these two costs or $321.63 per vessel. In addition, 127 man-hours have been saved in fabricating the vessel with wide plates.

As the length of the shell increases, wider plates are required for the two-piece construction, and the width extra cost may approach the extra fabricating cost for the three seams. Regardless of length, however, 127 man-hours of fabricating time will always be saved on the 120 in. ID vessel by the use of the two-plate construction. The maximum width that can be used economically for 1 in. thick plate in the two- or three-course construction is about 155 in. It is uneconomical to use plates under 100 in. wide in any of the combinations.

Very Wide Plates Costly

The economic advantage of wide plates varies with the number of courses used in a vessel. Beyond three courses, the actual saving in cost effected through the use of wider plates becomes less. This is because the widest plates possible carry high width extras and cost so much that considerable fabrication can be done for less than the width extra cost. Nevertheless, it is always true that the wider plates reduce the man-hours of labor required for fabrication of the vessel, thereby speeding output and increasing production volume and plant capacity without additional investment in plant or equipment.

In Fig. 11, the four vessels varying from 26 to 32 ft in length may be made up of either two, three or four courses. The bar charts show the total cost of width extra or of extra fabrication or a combination of both. In all four cases, the three-course construction is seen to be cheapest.

As an example of the procedure in calculating, the 30 ft vessel can be made of two 180 in. courses, three 120 in. courses or four 90 in. courses. The two-course vessel has a total width extra cost of $651.16. In the three-course vessel, the total width extra is reduced to $88.95, to which must be added the cost of the extra seam. At $11.66 per ft for the vessel's 31 ft 6 in. circumference, the extra seam costs $369.62, making a total of $458.57. Thus the three-course construction saves $192.59 over two-course construction. There is no width extra in the four-course construction, but two extra seams must be made at a cost of $758.64. The cost of the four-course construction is therefore greater than for two courses and much greater than for three courses.

Fig. 11 also shows the cost for shell lengths from 34 to 44 ft for a diameter of 120 in. and 1 in. gauge. The selection of the optimum construction will not be affected by the diameter of the shell since both the total width extra costs and the circumferential seam fabrication costs vary in direct proportion to the diameter. Fig. 12 continues the cost bars for a 120 in. vessel for shell lengths from 46 to 64 ft.

Optimum Construction

The most economical width of plate can be quickly determined from these bar charts. For the 50 ft vessel, the five-course construction with 120 in. plates is lowest in cost. The four-course unit involves a total width extra of $736.44; the five-course construction costs $517.87 for width extra and additional fabricating cost. The six-course vessel involves an extra welding cost of $739.24 due entirely to the cost of the two additional seams plus $36.36 for the extra metal involved as overweight, making a total of $775.60. The sum of $1,141.13 for the seven-course unit is the cost of the three extra seams.

Taken together, Figs. 11 and 12 show that the four-course construction is cheapest between the lengths of 36 ft up to and including 42 ft, and then the five-course type becomes most economical. As the length of the vessel increases, the six-course structure becomes the cheapest at a length of about 56 ft, and this gives way to a seven-course structure at about 64 ft.

The optimum constructions correspond to plate widths between 100 and 130 in. Increasing the plate width over 130 in. will increase the width extras more than it will decrease the fabricating cost. Hence the designer's problem is to find the particular combination of width extras and fabricating operations which will produce the lowest cost construction. Where one or two courses are involved (1 in. gauge), plates up to 185 in. may be used to advantage; where the choice of construction lies between two or three courses, plates up to 155 in. are most economical; where three or more courses are involved, the economical limit is scarcely more than 130 in.

Figs. 11 and 12 also emphasize the fact that plates less than 100 in. wide are uneconomical for a 1 in. gauge structure.

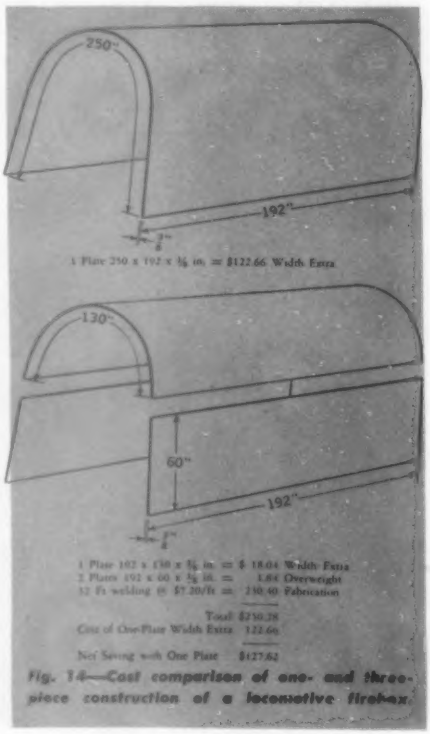

250"
192"
1 Plate 250 x 192 x 1 in. = $122.66 Width Extra
130"
60"
192"
1 Plate 192 x 130 x 1 in. = $ 18.04 Width Extra
2 Plates 192 x 60 x 1 in. = 1.84 Overweight
32 Ft welding @ $7.20/ft = 230.40 Fabrication
Total $250.28
Cost of One Plate Width Extra 122.66
Net Saving with One Plate $127.62

Fig. 14—Cost comparison of one- and three-piece construction of a locomotive firebox.

Table III. Maximum Economical Width of Course, in.

No. of Courses	½ in. Plate	1 in. Plate	2 in. Plate
1 or 2	195	185	176
2 or 3	175	155	140
3 or more	†130	†130	†130

† Where the saving in man-hours of fabrication time is important, these widths may be substantially increased.

½ and 2 in. Plates

Similar cost data for ½ in. gauge are presented in Fig. 13. Considering a ½ in. gauge vessel of 10 ft diameter, if the choice is between two wide plates and three narrow ones (with the fabrication cost of the circumferential weld at $8.51 per ft), the three-course construction exceeds the cost of the two-course type up to approximately 175 in. As the length of the vessel increases, the three-course vessel is seen to be lower in cost than either the two- or four-course construction. As with the 1 in. gauge, the optimum width for three or more courses is between 100 and 130 in.

For 2 in. gauge combinations, the trend is similar, but the limits in the two- or three-course vessel constructions are at a slightly lower plate width than either the ½ in. or 1 in. gauges; namely, 140 in. Where the length of the vessel may be made up of two, three or four courses from plates of corresponding widths, the most economical width does not exceed 130 in.

Table III summarizes the results for different thicknesses of plate and numbers of courses. Every combination should use plates over 100 in. wide in order to obtain maximum economy.

Saving Man-Hours

In long vessels constructed of multiple courses, plates more than 130 in. wide appear to be at a disadvantage if cost figures alone are taken into account. However, other benefits derived from their use, including the reduction of man-hours and of equipment needed for fabrication, may offset the higher cost. As an example, let us consider a cylindrical shell 30 ft long of ½ in. gauge. It may be made of two plates 180 in. wide, of three plates 120 in. wide with an extra weld seam or of four plates 90 in. wide with two extra weld seams. For the two-course shell the only extra cost is the width extra applicable to 180 in. plates, in this instance totaling $343.66. The three-course shell requires an additional seam costing $268.49 and has a width extra of $51.96 or a total extra cost of $320.45. Hence the three-course shell saves only $23.21 over the two-course shell and to effect this small economy requires 89 more man-hours in fabrication, or two men employed for a 45 hour week. Obviously, it would be better business to put these two men on the production of additional vessels since greater total income would be obtained.

In like manner, the 64 ft long drum of 1 in. thick plate shown in Fig. 12 indicates the seven-course combination to be lowest in cost. It is less costly than the six-course vessel by approximately $24 and cheaper than the five-course one by about $109. However, compared with the six-course construction, the extra fabricating time is 123 hours. Compared to the five-course unit, the additional fabricating time is 246 hours.

The waste of the additional 123 man-hours needed to effect the saving of $24.22 in money by using the seven-course vessel instead of the six is only outweighed in careless estimating by the saving of $109 at the cost of 246 more man-hours of fabrication time by failing to select the five-course, 154 in. wide plates. The moral is, of course, that the estimating engineer should consult his firm's manpower reserve as well as its cash in selecting the combination of plates to make up the vessel.

Fig. 15—Comparison of width extras and welding costs for 10% nickel-clad steel, U-68 and U-69 fabrication.

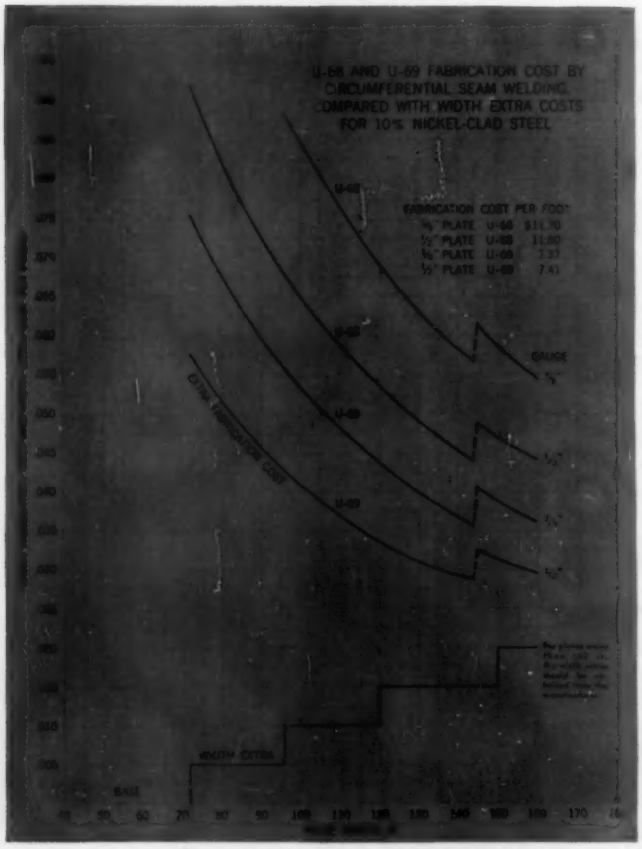
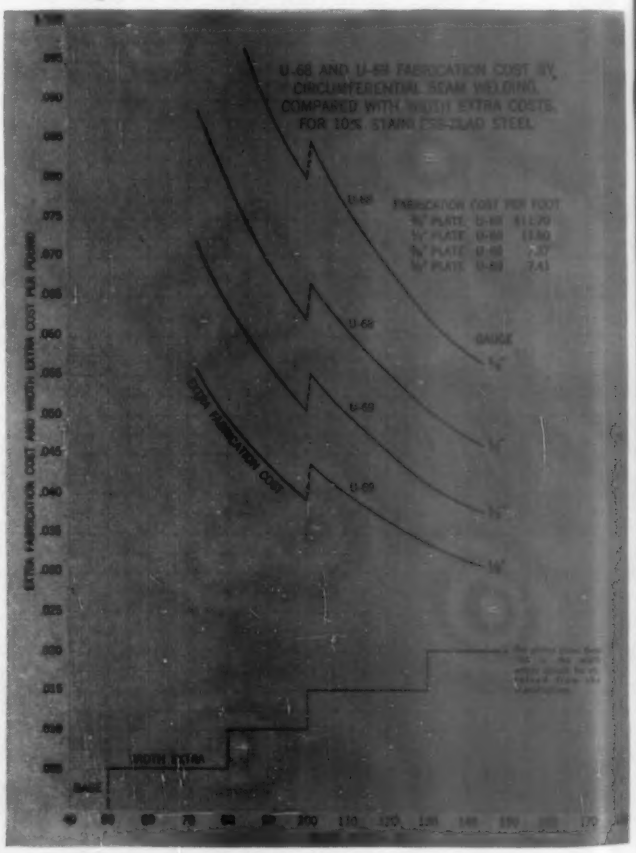

U-68 AND U-69 FABRICATION COST BY CIRCUMFERENTIAL SEAM WELDING COMPARED WITH WIDTH EXTRA COSTS FOR 10% NICKEL-CLAD STEEL
FABRICATION COST PER FOOT
GAUGE
EXTRA FABRICATION COST
WIDTH EXTRA

Fig. 16—Comparison of width extras and welding costs for 10% stainless-clad steel, U-68 and U-69 fabrication.


U-68 AND U-69 FABRICATION COST BY CIRCUMFERENTIAL SEAM WELDING COMPARED WITH WIDTH EXTRA COSTS FOR 10% STAINLESS-CLAD STEEL
EXTRA FABRICATION COST AND WIDTH EXTRA COST PER FOOT
GAUGE
EXTRA FABRICATION COST
WIDTH EXTRA

One fabricator who used one 154 in. wide plate instead of two 77 in. plates was able to increase his production from 15 vessels to 20 vessels per week—an increase in production of 33⅓% effected without additional investment in men or plant.

Wide plates offer an additional advantage where welded joints have to be inspected in the field after certain periods of operation. By reducing the number of seams, wide plates keep such service costs at a minimum.

Allowable Overweight

The "allowable overweight" of steel plates has sometimes been considered as an objection to the use of wide plates. As the width of the plate increases up to 168 in., the allowance for overweight likewise increases. From 168 to 195 in., the percentage overweight allowance remains constant.

The cost of wide plates *is* increased by this overweight, but the increase is only a small fraction of the savings in fabricating costs and man-hours which are effected by the use of wide plates. The following example illustrates the point:

A vessel could be built either of two plates 240 by 144 by ½ in. or of three plates 240 by 96 by ½ in. The increased overweight allowance for the two 144 in. plates is $20.54, which includes the base price, quality extra and width extra involved as a result of the overweight. The overweight cost plus the width extra cost for the two 144 in. plates is $118.48. The extra fabricating cost plus overweight for the three-course construction is $178.78. Despite the greater overweight allowance, the 144 in. plates show a net saving of $60.30 per vessel.

The preceding considerations determining optimum plate widths apply equally to plates of low-alloy steel. The width extras for such steels are somewhat higher in proportion to their fabricating costs, however, and therefore the maximum economic width is found to be approximately 10% lower than the carbon steels.

Locomotive Fireboxes

Wide plates always result in savings of money, time and manpower when used in the design of one-piece crown and side construction of locomotive fireboxes. The widest and longest plate that can be produced shows definite economic advantage in such structures. In the usual range of sizes, the saving by the use of one-piece construction as compared with three-plate construction is about $140 per unit.

The use of a plate up to 192 in. wide and 250 in. long requires the handling, rolling and assembling of one plate only. The three-piece construction requires the laying out, forming, beveling and welding of two extra joints, and the cost of such work is always in excess of the width extra involved for the wider plate. An example is shown in Fig. 14. The extra fabricating cost, overweight cost and width extra cost of the three-piece crown and side is $250.28, while the one-piece unit involves a width extra of $122.66. The net saving with the one-piece unit is $127.62, or $50.05 per ton of firebox plate.

In one-piece crown and side construction, the width of the plate generally makes up the length of the firebox, and the length of the plate develops the girth.

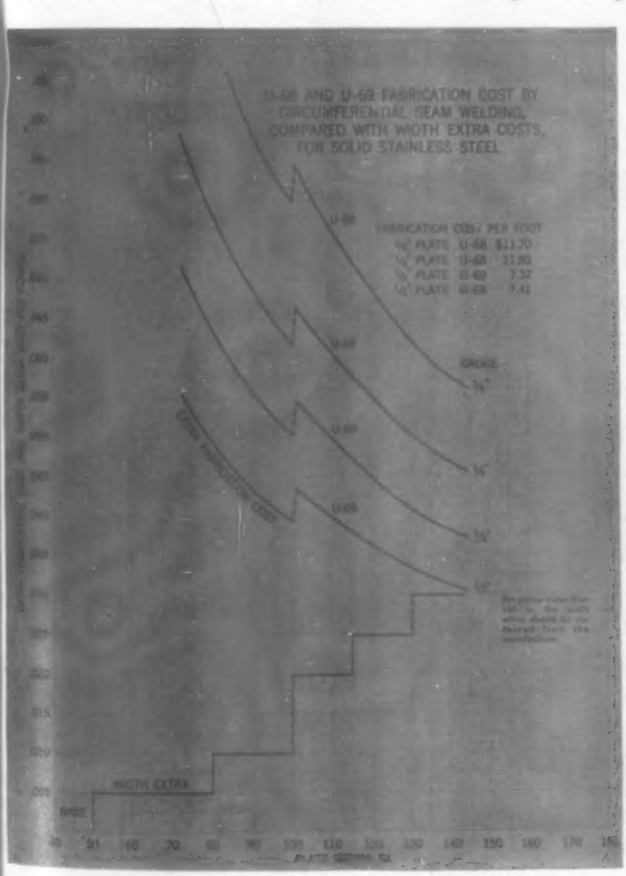

U-68 AND U-69 FABRICATION COST BY CIRCUMFERENTIAL SEAM WELDING, COMPARED WITH WIDTH EXTRA COSTS, FOR SOLID STAINLESS STEEL
WIDTH EXTRA

Fig. 17—Comparison of width extras and welding costs for solid stainless steel, U-68 and U-69 fabrication.

Clad Steels

The use of wide plates of clad steel shows even greater savings than with the carbon steels as both the base price of the material and the fabricating costs are higher in proportion to the width extras for the clad steels. The fabricating costs are increased by the care necessary in working the clad materials and by the cost of such accessory metals as welding electrodes. Hence the widest possible clad-steel plate should always be used; all known examples show savings.

A comparison of width extras and welding costs for 10% nickel-clad steel, converted to costs per lb of plate material used, is shown in Fig. 15. For an example, consider a ½ in. gauge plate fabricated in accordance with U-68 requirements at $11.80 per ft. The extra fabricating cost of using two 42 in. plates to make up an 84 in. plate by welding would be $0.078 per lb; a single plate 84 in. wide would cost $0.005 per lb in width extras. The wider plate thus results in a saving of $0.073 per lb—almost half of the base price of the material—in addition to the other advantages of conserving time and man-hours.

As a further illustration, a single plate 108 in. wide would have a width extra cost of $0.010 per lb; the fabricating cost to join two 54 in. plates of ½ in. gauge by U-69 construction would cost almost $0.038 per lb. The saving by using the single wide plate would therefore be $0.028 per lb.

Similar curves for stainless-clad steels are given in Fig. 16. From these it may be seen that a single plate 108 in. wide can be purchased for a width extra of $0.015 per lb; two narrow ⅜ in. plates, 54 in. wide, have a U-69 fabricating cost of $7.37 per ft and would cost $0.0509 per lb to join together. The use of the wide plate effects a saving of $0.0359 per lb as well as the savings in shop time.

Solid Stainless

The high priced solid stainless steels and non-ferrous metals show similar savings for wide plates. Fig. 17 gives data on width extras and extra fabricating costs for plates of stainless steels. A single ½ in. plate 84 in. wide may be purchased for a width extra of $0.01 per lb. To weld two narrow plates each 42 in. wide to form a plate 84 in. wide would cost $0.0469 per lb for the extra fabrication required by U-69 construction at $7.41 per ft. The saving due to wide plates in this case is $0.0369 per lb.

THE END

★ PRODUCTION

Automatic Carbon-Arc Welding

Fig. 1—Only one pass was necessary on both the longitudinal and circumferential seams of aluminum tanks fabricated by the automatic shielded-carbon-arc process.

Aluminum is being successfully welded in production set-ups by means of the automatic shielded-carbon-arc process. Speed, quality and economy can be obtained.

By **W. J. CONLEY**
Consulting Engineer, The Lincoln Electric Co.

Fig. 2—A dense, even bead of weld metal is an inherent characteristic of the automatic carbon-arc process.

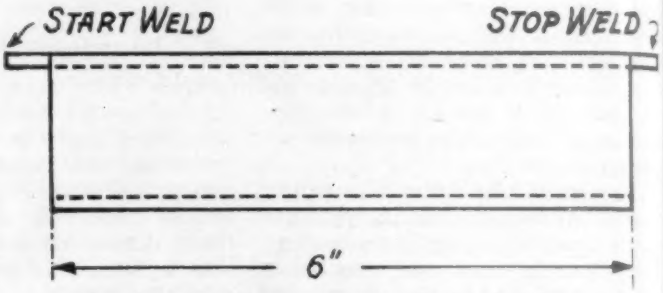


Fig. 3—Scrap pieces were tacked on the tank shell to serve as starting and stopping points for the weld bead.

THE automatic shielded-carbon-arc welding process has rapidly become favored by volume producers of such items as tanks, pipe, vaults and similar structures as it combines unusually low costs of construction with welds of exceptionally high quality.

Fabricating Aluminum Tanks

One interesting application of the automatic welding of aluminum consisted of the fabrication of thousands of tanks from ¼ in. aluminum plate. These vessels have a dished head on one end and measure 6 ft in length by 24 in. in diameter. The specifications called for a strongly reinforced seam inside and out (see Fig. 1). High-speed fabrication was obtained by welding both the longitudinal and girth seams in one pass, producing a high-quality bead of the kind in Fig. 2.

The tank shells were first tack welded, and a short length of scrap was tacked at each end of the joint, as shown in Fig. 3. Serving as starting and stopping points during the automatic welding, these scrap pieces were knocked off the work after the longitudinal seam had been finish welded. Both the longitudinal and girth seams were square butt welds, made without beveling or other joint preparation.

An automatic machine of the type shown in Fig. 4, known as the "Electronic Tornado," was used, making possible a travel speed of 16 in. per minute. With this system, the carbon arc is fully controlled by focusing the heat in a concentrated area directly underneath the arc. A dense, uniform bead is obtained by automatically depositing an autogenizing element (powder flux) directly on the work just ahead of the arc. The powder melts and forms a protective slag.

To weld the ¼ in. aluminum plate, 3/16 in. filler wire having the same specifications as the parent metal was used in conjunction with a ⅜ in. carbon. The machine was set at 350 amperes and 35 volts. According to the manufacturers, excellent results were obtained. Careful testing of each tank showed the leakage to be negligible.

Joining 26 in. Pipe

The practicability of welding aluminum structures by the automatic car-

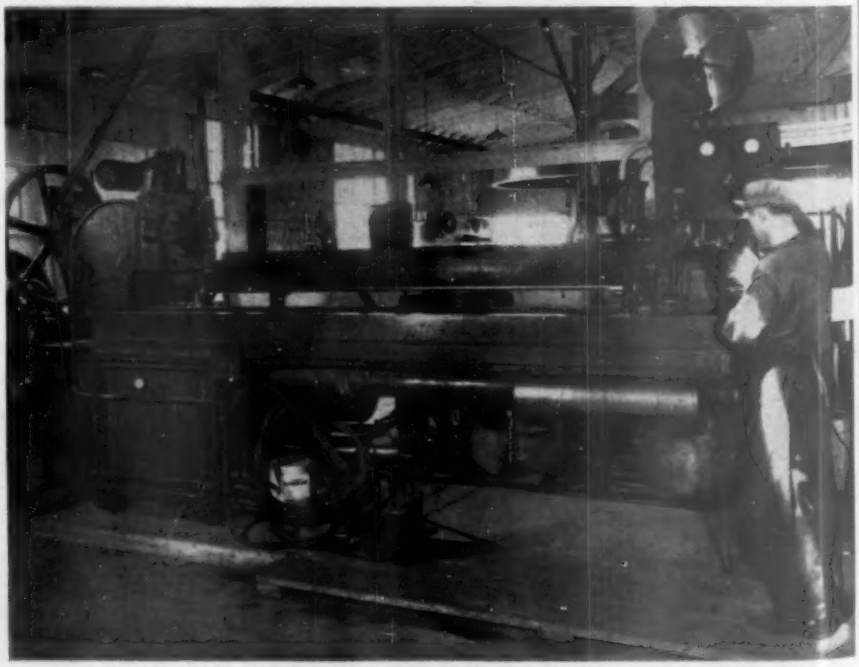
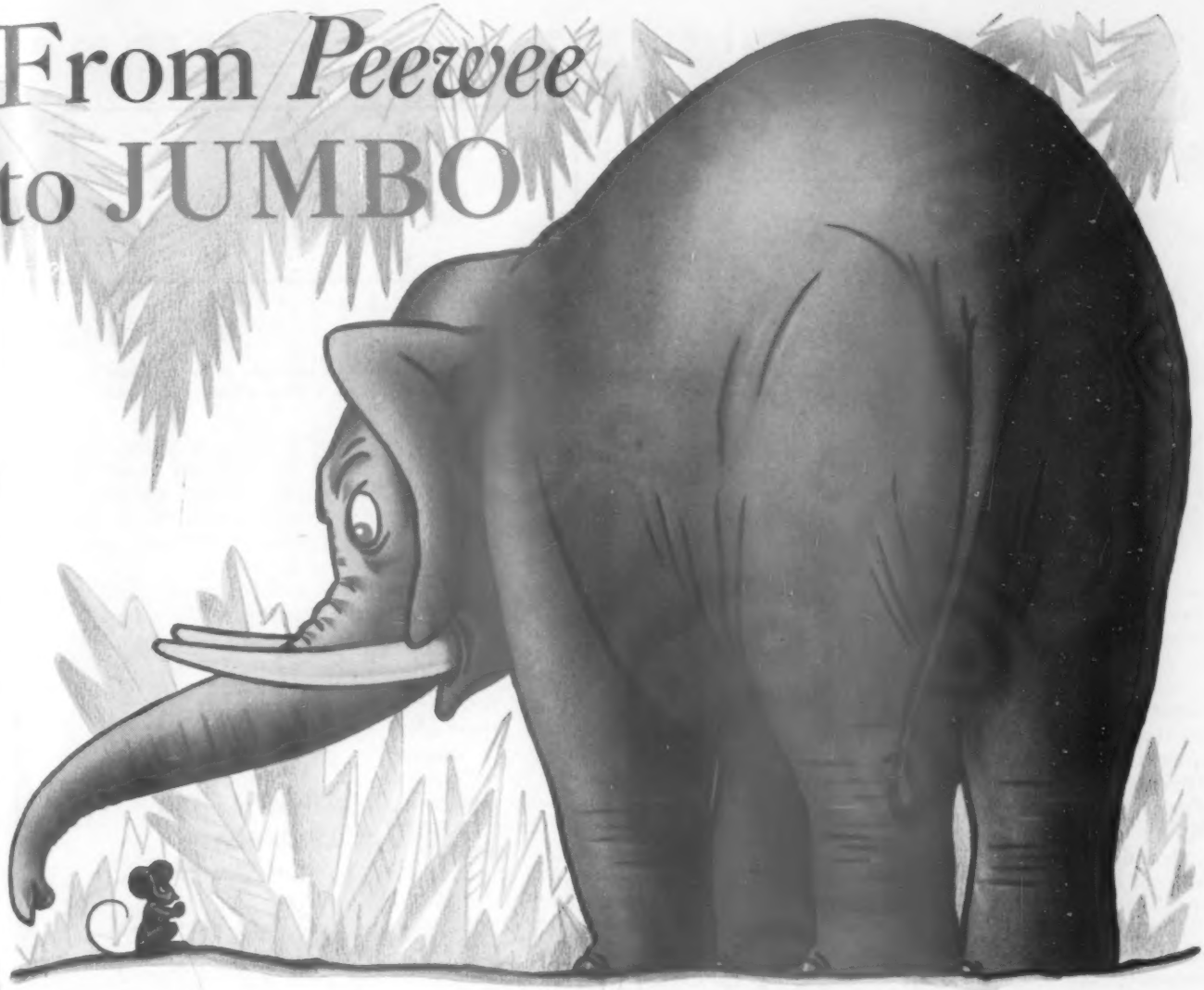


Fig. 4—"Electronic Tornado" machine for automatic carbon-arc welding.

From *Peewee* to JUMBO



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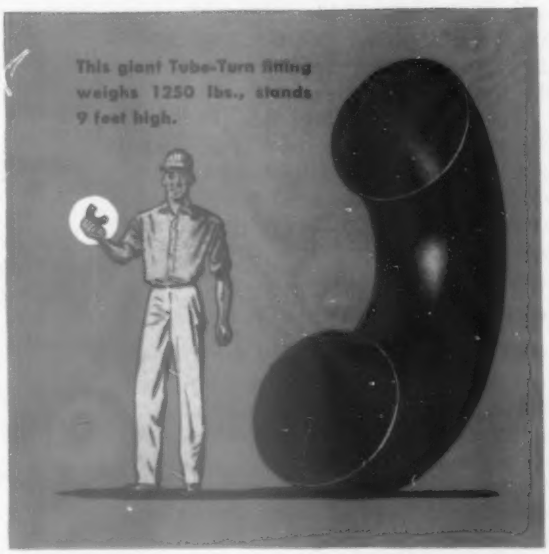

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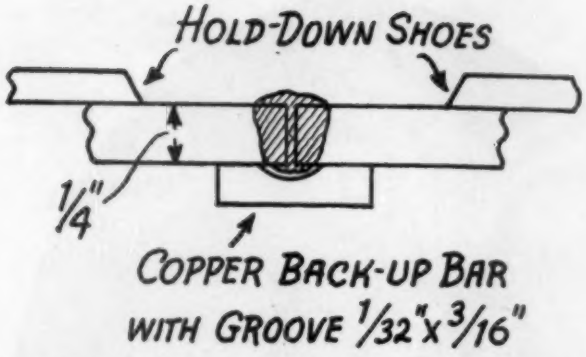

Fig. 5—Cross-section of 26 in. pipe welded by the automatic process. Note the hold-down shoes and copper back-up bar.

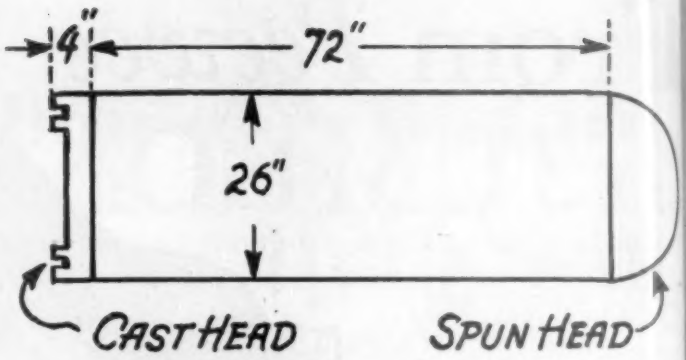

Fig. 6—Set-up for welding a cast head and a spun head to an aluminum tube 26 in. in diameter and 1/4 in. thick.

bon-arc welding process is further evidenced by another current application—the fabrication of 26 in. diam, ¼ in. thick aluminum pipe in 72 in. sections.

As in the arc welding of the tanks previously described, the pipe joints were plain butt welds made without beveling. The formed pipe was placed in a horn-type jig. The hold-down shoes (Fig. 5) were located adjacent to the seam. The work was bowed upward approximately ⅜ in. at the joint when clamped in the fixture to compensate for distortion due to heat. A copper back-up bar having a 1/32 by 3/16 in. groove was placed along the underside of the seam. The machine was set at from 360 to 380 amperes and 33 to 34 volts.

As the current from the carbon electrode penetrated the joint, the molten metal took the form of the backing strip, reinforcing the underside of the seam. The added 5/32 in. filler rod supplied the metal producing the necessary reinforcement on the top side of the seam.

The speed of travel was 16.5 in. per minute, and 22 in. of 5/32 in. filler rod were consumed per foot. An aluminum flux was used throughout as an autogenizer, 1.2 oz of flux being used per ft of weld at a cost of 4.9 cents per ft.

Heads Welded to Tube

Still another interesting automatic welding setup was presented by the welding of aluminum-alloy heads to an aluminum tube, ¼ in. thick and 26 in. in diameter (Fig 6). A cast head was welded to one end of the tube, and a head of spun aluminum to the other end. To weld the cast head, two rings were located adjacent to the joint to act as a dam for the flux (Fig. 7). A 5/32 in. aluminum filler rod was used for this application, with 325 amp and 32 volts. A speed of 14 in. per minute was maintained.

In welding this casting, the carbon arc was positioned one inch off center

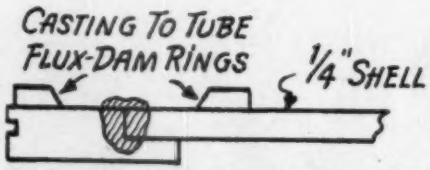

Fig. 7—A flux dam was made with two rings before joining the cast head to aluminum tube.

to the left while the work was rotated clockwise (Fig. 8).

In welding the spun head, the work was first positioned in a removable copper backing jig (Fig. 9) which had a groove at the joint in the holding arm. Here, again, a flux dam was provided by means of shoes located adjacent to the joint. The same machine current, voltage and speed prevailed as in the welding of the cast head; also the same flux and same type and size of filler rod were employed.

Carbon-Arc Advantages

All of the cases presented indicate that the automatic shielded-carbon-arc method is extremely efficient for the welding of aluminum as well as for other metals. In addition to the advantages of high quality and low cost, the process is fast because:

1. The joints are square butt (no bevel) and therefore require very little deposited metal as compared to the joint with a beveled edge.

2. Since the filler metal does not carry the welding current, the size of the wire (5/32 or 3/16 in.) does not limit the maximum current.

3. The amount of flux can be regulated to meet the requirements of the high welding currents because the flux is introduced to the arc independently of the filler metal or the carbon electrode.

4. Uniform travel speed and automatic control of the current, voltage, filler metal and flux permit the use of high welding currents.

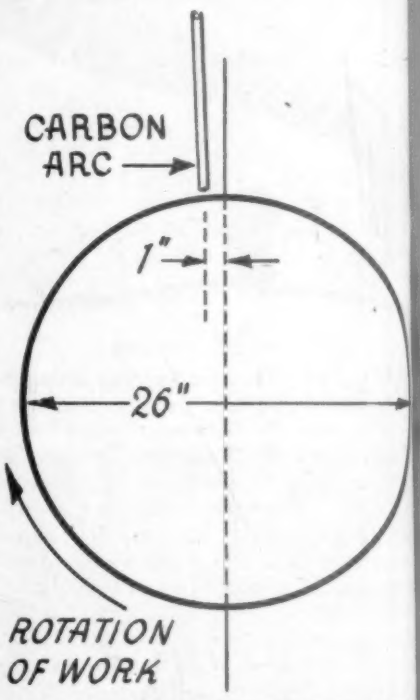

Fig. 8—In welding the cast head, the carbon arc was positioned one inch off center; this aided in controlling the flow of weld metal.

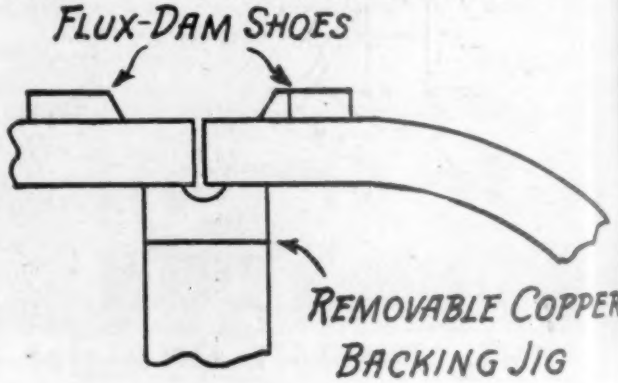

Fig. 9—To weld the spun aluminum head, the work was positioned in a copper backing jig. Flux-dam shoes were also used.

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Turntable Soldering

Two people can accomplish the same amount of work that formerly required six—by means of a clever soldering fixture developed by engineers of the Bryant Heater Co., Cleveland, O., one of the Dresser Industries. The fixture is used in the soft soldering of a threaded adapter to a brass tube in order to produce a lubricating spring assembly for amphibious tractor bogie wheels.

The adapter has a turned shoulder over which the ¾ in. brass tube fits. Tube and adapter are put together by one of the two operators and loaded into the first station of the four-station rotary table (see illustration). The table is then indexed a quarter turn to the second station, where a gas flame automatically preheats the joint to be soldered.

At the third station the second operator puts solder on the joint and rotates the assembly between two fixed torches; at the same time she presses tube and adapter to a close fit. Another quarter turn of the fixture brings the assembly to the fourth station, where a blast of air is directed from two nozzles to cool the joint. The air stream is controlled by a raised plate on the base of the rotary table, which plate depresses a turn-on button when the assembly comes into position.

Unloading and inspection are accomplished by the first operator when the assembly has completed the circle and returned to its starting point.

Four-station fixture for soft soldering a threaded adapter to a brass tube. The two girls in the foreground now turn out the amount of work formerly accomplished by six operators.

» «

Plate-Landing Bracket

By Herbert Mewton

Until recently the shell plates for the bilge sections of ships built at Marinship, Sausalito, Calif., were landed on brackets welded to the bilge sections. The plates were handled by gantry cranes, and the brackets guided them into place. Since the brackets were welded, their installation and removal naturally involved welding, chipping and other reclamation operations.

I submitted a suggestion to our Labor-Management Committee for a portable bracket that would eliminate all welding, chipping and reclamation operations. This suggestion was ultimately accepted, and the bracket is now being used.

This bracket is merely a triangular-shaped plate having a slot which fits over the bilge plate and a cam surface by which the plate is guided into position. The bracket is also provided with a handhole for ease in handling. Since the adoption of this idea, these brackets have been in constant use and are now looked upon by the plate hangers as one of their standard tools.

Mr. Mewton and the triangular bracket he invented to simplify the handling of shell plating for the bilge sections of ships. The bracket has a small slot which just fits over the upper edge of the plate previously laid in place.

Approximately 1½ hr are saved on each plate laid.

» «

Welding Sheet Metal

By Glenn Whitmore

All sheet-metal installations used on the hulls at Permanente Metals Yard No. 2, Richmond, Calif., had to be soldered because welding generated too much heat and would warp and burn the sheet metal. Soldering also tended to warp the sheets, but the warpage was not as great. The preferred process, however, was slow and costly.

I devised a scheme by which these sheets could be welded and submitted this suggestion to the War Production Drive Committee. The idea was ultimately accepted and in consequence sheet-metal installations for the refrigeration rooms on Victory ships are now welded.

To weld the sheets, they must be lapped slightly rather than butted (as can be done in soldering). An "Everdur" bronze welding rod is laid along the seam and melted into place by a carbon electrode. For the latter we use a metal-arc electrode holder. The method of welding is quite similar to the procedure used in gas welding, and any good weldor can usually learn how to weld with a carbon electrode.

The welding of these sheets not only overcomes all of the previous difficulties encountered in sheet-metal installation but has appreciably speeded up the job. Previously, approximately 500 man-hours were required to solder the sheet metal in a refrigeration room. Now a complete installation can be welded in place in 100 man-hours. The saving of 400 man-hours per hull naturally reduces the cost of building ships. On a basis of six hulls per month, 2,400 man-hours are saved.

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Magnesium Welding

By P. Mendenhall and S. Carroll

THE Heliarc welding of magnesium has always been considered a process that required lots of tooling. Considerable steel is required for hold-down bars and back-up plates, and a great deal of work is necessary to make these fixtures of the proper shape.

We suggested an idea to the Labor-Management Committee at Northrop Aircraft, Inc.; the suggestion was adopted, and as a result a new shop technique in the welding of magnesium airplane parts has been developed.

Our idea was simply the use of magnesium hold-down bars and back-up plates in place of the steel equipment formerly used. The theory behind the suggestion was that the use of metals with thermal conductivity and specific heat comparable to those of the part being welded would cause the welding heat to spread uniformly rather than to be concentrated in one area. It was the concentration of heat in the steel fixtures that resulted in warpage and distortion of the magnesium parts.

As a result of this suggestion, more uniform results have been obtained, making magnesium welding more practicable. There has been less distortion and warpage of the material during the welding operations. Welding costs have been decreased; production increased by much of the time formerly lost in tooling design and building labor. Tooling costs have been considerably reduced, and a non-critical material (magnesium) is used to build the fixtures.

» «

Surface-Grinder Handle

By Ora A. Jackson

DIFFICULTIES are frequently experienced in surface-grinding operations because all grinders come equipped with a handle at the rear of the grinding head. A handle placed in such a manner results in uneven distribution of the machine weight. This condition causes extremely high operator fatigue, particularly when vertical surface grinding is being done.

To overcome this difficulty, I suggested the installation of an auxiliary handle on our surface grinders. The Joint Labor-Management Committee at Consolidated Steel Corp., Wilmington, Calif., approved this suggestion, and it was put into operation.

The auxiliary handle is fastened horizontally to the original handle with an off-center connection. This places the weight on a more common axis so that the grinder is easier to operate. The operator is also able to obtain a better grip. As a result of this handle, the fatigue factor has been reduced 50%. The safety factor of the grinding operation has also been greatly increased because of the better grip and balance afforded the operator. Though this idea is quite simple, it is greatly appreciated by those engaged in surface grinding.

Weld grinding is made easier with an auxiliary grinder handle fastened at right angles to the original handle.

» «

Weldors' Arm Support

By May S. Mose

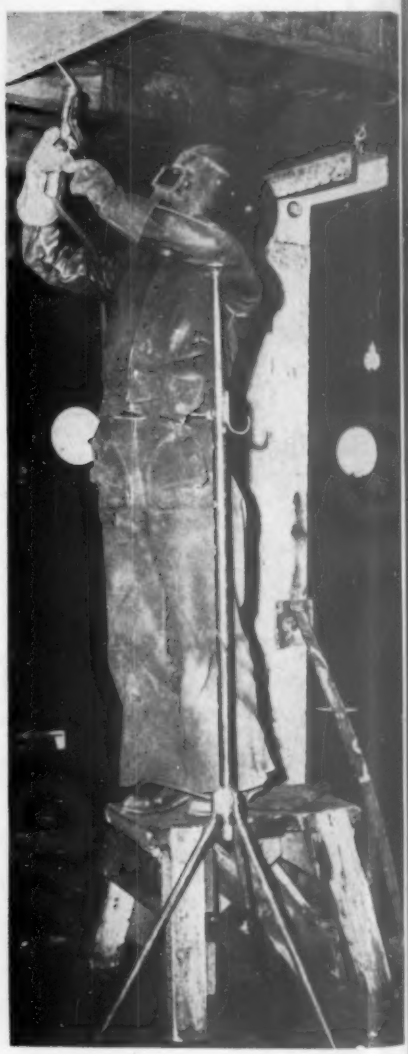
OVERHEAD welding is at its best a tough job, and after doing it all day long your arm feels like it's just about to break off. Naturally the more tired you get, the slower you produce.

I suggested the building of an arm rest for use in overhead welding; this suggestion was adopted by the War Production Drive Committee at Marinship Corp., Sausalito, Calif., and the rest is now in use. It is a rather simple device. By supporting the arm, it also prevents the weldor's body from dangerous swaying when he is standing on a bench, ladder or scaffold in order to weld overhead.

This arm rest consists of a vertical 1 in. ID pipe mounted on a tripod. In the pipe is placed a rod having a disc welded to one end. The disc is 6 in. in diameter and ¼ in. thick. The rod moves freely up and down and can be adjusted at the desired height by a set screw. When it has been properly adjusted, the weldor may rest his free arm on the 6 in. disc and support the stinger arm with his free hand as he works. By thus supporting the elbow of the working arm, the weight of the stinger and cable is transmitted through the free arm to the arm rest.

Not only is fatigue reduced by this device, but a steady arc can be maintained, improving the quality of the work. The added stability permits the weldor to burn the electrodes to shorter stubs. Because of the lessened fatigue when he uses this arm rest, he can do approximately twice as much overhead welding in the same length of time.

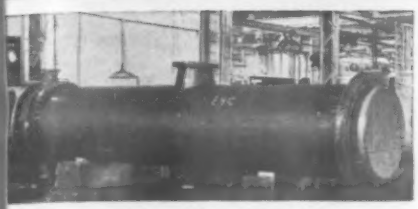
Arm rest to ease overhead welding. The arm with the electrode holder is supported by the free arm, which rests upon the circular plate.



STRONG, SOUND WELDS

. . . well done!

A typical Monel arc weld made with No. 130X Monel electrode.



Monel is extensively used for lining heat exchanger shells. This steel shell is lined with .078" Monel sheet, arc welded with No. 130X Monel electrode. Photo courtesy of The Lummus Company.

Both plug welding and strip welding are employed for lining fractionating and other steel process equipment with Monel sheet or strip. No. 130X Monel electrodes are used. Photo courtesy of Wyatt Metal & Boiler Works.

No. 130X Monel electrodes are also used for welding Monel Clad steel as in this fractionating tower which is six feet in diameter and 43½ feet in length. The top 15½' section is Monel Clad Steel 22/32" thick with ⅛" of Monel cladding. Manways and covers are lined with ⅛" Monel sheet by plug welding. Photo courtesy of Edge Moor Iron Works, Inc.

* * *

The elbows below were readily fabricated from Monel sheet and then arc welded with No. 130X Monel electrodes. Photo courtesy of Farwell, Ozmun, Kirk & Co.

Electric arc welding with Monel offers several important advantages.

Monel is easily fabricated by methods similar to those used in making quality welds in steel. It may be welded in all positions with the same facility.

Monel's coefficient of expansion is the same as that of steel. This permits steel and Monel to be used on the same job.

Welds are sound and ductile. In addition, they are as strong and as highly resistant to corrosion as the parent metal. No thermal or chemical after treatment is needed to restore the corrosion-resistant qualities of the welded joints.

As indicated in the photographs, No. 130X Monel Arc Welding Electrodes are employed for welding all forms of wrought and cast Monel to Monel, or Monel to steel.

Engineering data, working instructions, and helpful information on welding procedures are contained in Bulletin T-2, *Welding, Brazing and Soft Soldering of Monel, Nickel and Inconel.* A copy of this well-illustrated, 32-page bulletin will be sent on request.

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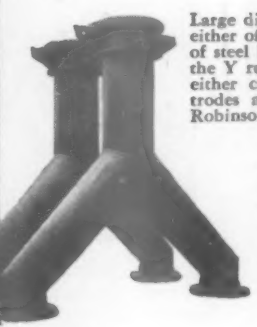
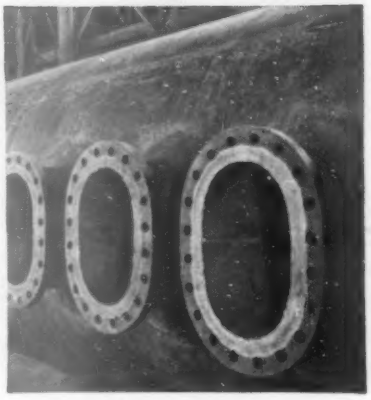
No. 130X *Monel* ELECTRODES



Large diameter piping may be made either of Lukens Monel Clad steel or of steel lined with Monel sheet as in the Y reducers shown at the left. In either case, No. 130X Monel electrodes are used. Photo courtesy of Robinson Engineering Company.

* * *

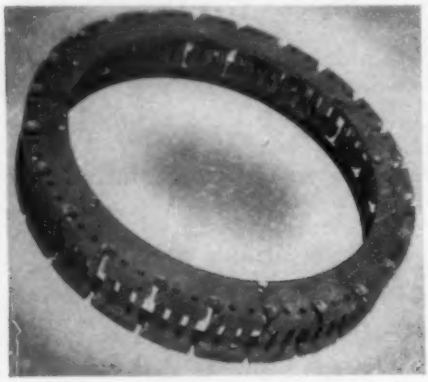
The steel bolt circles of these manways are overlaid with Monel by a 2-layer weld of No. 130X Monel electrode. Photo courtesy of Edge Moor Iron Works, Inc.



On the Job

Hard-Faced Inspection Cages

FABRICATION of a cage to hold 24 cylindrical parts for inspection purposes presented an interesting application of hard-facing. The body of each cage was made from a forged ring 17¾ in. OD, 13 in. ID and 3.2 in. thick. The ring was machined to the shape shown in the accompanying picture in order to provide 24 equally spaced slots to receive the parts to be inspected. Since it is important to preserve the exact dimensions of these openings, hard-facing was prescribed for the areas subject to wear. Altogether, 72 hard-facing deposits had to be applied to each cage.



Courtesy, C. E. Phillips & Co.

Top view of inspection cage, showing points of application of hard-facing.

The hard-facing was applied by gas welding, and the deposits had a hardness of approximately 63 Rockwell C. The particular alloy chosen forms a smooth, wear-resistant deposit, which characteristic determined its suitability for the particular purpose of maintaining the precise dimensions.

The bottom of the cage was formed by welding on a stiffening ring. The completed inspection tool makes it possible to check the dimensions of small parts very rapidly.

Welded Bending Roll

CAPABLE of forming mild steel plates up to 1½ in. thick and 36 in. long, a new bending roll made by the Baldwin Southwark Division of the Baldwin Locomotive Works, Eddystone, Pa., is of strongback construction, owing its rigidity and precision of operation to three huge welded girder beams. This bending roll is employed to form heavy ship plates, and it has a screwdown capacity of 1,200 tons—certainly no small amount!

The strongback girders were fabricated by Lukenweld, Inc. and By-Products Steel Corp., associates of Lukens Steel Co., Coatesville, Pa. The load is carried by the two bottom beams, which are symmetrical, *i.e.*, a left and a right. Each of these girders measures 49 ft 8½ in. long by 5 ft 8¾ in. high by 2 ft 6 in. wide, weighs 57,980 lb. The top plates are 4½ in. thick and were flame-cut to shape. The bottom plates, 4 in. thick, were made in two sections. These plates were flame-cut and then rolled to shape in the Lukens flanging department. The two web plates are ⅞ in. thick, spaced 12 in. apart and reinforced with 1 in. stiffening ribs.

The top girder beam measures 40 ft 8 in. long by 6 ft ¾ in. high by 2 ft 6 in. wide, weighs 56,480 lb. The top plate is 4½ in. thick and was flame-cut and rolled to shape. The bottom plate is 5 in. thick and was flame-cut to shape. As in the case of the bottom beams, the two web plates are ⅞ in. thick, spaced 12 in. apart and are reinforced by 1 in. stiffening ribs.

The completed machine is over 50 ft long and is said to be the most powerful strongback bending roll ever made. It is of the three-roll type, with a top roll 22 in. in diameter and two bottom rolls each 18 in. in diameter. Four sets of four large roller bearings back up the lower rolls.

« »

Welded Engine Heads

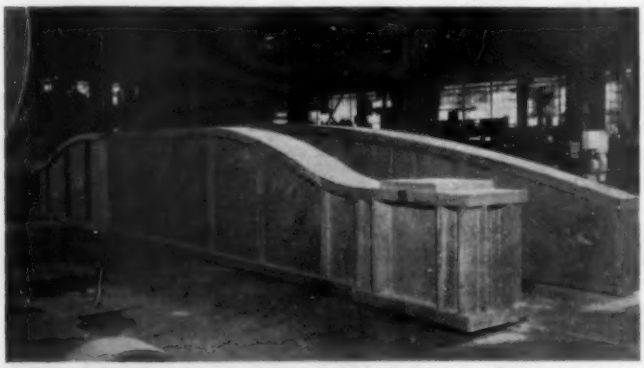
By R. L. Cannon

HERE in the oil fields of Illinois, equipment is worked hard and long. Under the strain of full-time service, a few field operators were having trouble with the cast-iron heads of oil engines. This type of engine head is apt to crack after heavy usage, forcing a shut-down.

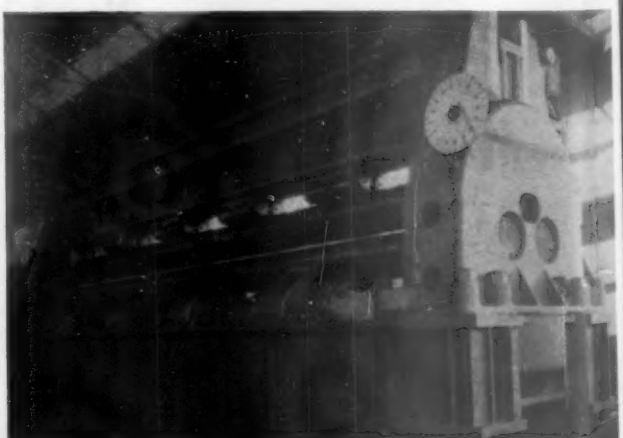
Courtesy, Harnischfeger Corp.

Side view of welded steel oil-engine head after fabrication and before machining. It cost only slightly more than a cast-iron replacement.

After it had replaced a number of engine heads, one company came to us for help. It was decided to make a fabricated head of steel to replace the cast iron, which had proved impracticable in oil-field work. Using the old iron head as a pattern, we made a new welded steel head for the 40 hp engine at a cost only slightly higher than that of a cast-iron replacement. The difference in cost is more than offset by the fact that the steel head will outlast a great many iron ones.



Two of three girder beams fabricated by Lukenweld, Inc., for use in the construction of a strongback bending roll by the Baldwin Southwark Division of Baldwin Locomotive Works. One of the two bottom girders appears in the foreground, the top girder in the background. Each bottom girder measures 49 ft 8½ in. long, 5 ft 8¾ in. high and 2 ft 6 in. wide; the top girder is 40 ft 8 in. long by 6 ft ¾ in. high by 2 ft 6 in. wide. Weights of the beams approximate 28 tons each.



The completed strongback bending roll has a screwdown capacity of 1,200 tons and is said to be the most powerful strongback bending roll ever made. It is capable of forming mild steel plates up to 1½ in. thick.

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RACO LINE

MILD STEEL ELECTRODES

Type—RACO	7, All Position, Reversed Polarity	AWS E-6010
"	11, All Position, A. C.	AWS E-6011
"	8, General Purpose, Poor Fit-up	AWS E-6012
"	13, General Purpose, Light Gauge	AWS E-6013
"	20, Horizontal Fillets	AWS E-6020
"	5, Deep Grooves	AWS E-6030

HIGH TENSILE STEEL ELECTRODES

Type—RACO	74, All Position, Reversed Polarity	AWS E-7010
"	64, Horizontal Fillets	AWS E-7020

STAINLESS STEEL ELECTRODES

Type—RACOLLOY	18-8, Unstabilized	Type 308
"	18-8Cb, Stabilized	Type 347
"	18-8(1.5% Mo)	Type 316
"	18-12(2-3% Mo)	Type 317
"	18-12(3-4% Mo)	Type 307
"	19-9, For Welding air-hardening steels	Type 309
"	25-12, Unstabilized	Type 310
"	25-12Cb, Stabilized	
"	25-20, Scale-resisting steel	

HARD SURFACING ELECTRODES

Type—RACO	25, 20-25 C Rockwell (Machinable Deposits)
"	45, 40-50 C Rockwell
"	55, 50-60 C Rockwell
	RACOLLOY Manganese, Austenitic Manganese Steel

LIGHTLY COATED ELECTRODES

Type—Blue Label, Sull Coated, Manual Welding	AWS E-4510
Type "D" Automatic or Manual Welding	AWS E-4520
Type "D" .30-.40 C, For surfacing	
Type "M" Automatic Welding	AWS E-4520

OXY-ACETYLENE WELDING RODS

Type—Red Label Copper Coated Mild Steel
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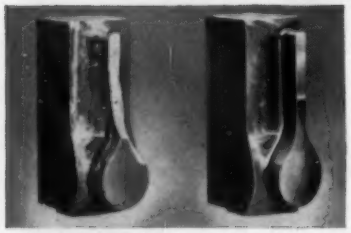

Die Unit repaired with Eureka Tool and Die Welding Electrodes. No heat treatment required.

Compositely Constructed Die Unit using Eureka Tool and Die Welding Electrodes. No heat treatment required.

Here are just a few examples of how Eureka Tool and Die Welding Electrodes are saving vital tool steel and countless man hours. 1. For repairing existing units that fail in operation. 2. For creating cutting edges or working areas in the composite fabrication of units using mild, medium, high carbon or S.A.E. steels as a base. 3. For correcting design by facilitating changes in contours, corners or edges during die "try-out" or "change-over" programs. 4. For rectifying errors made in manufacturing units eliminating conventional inserts. Shown at left are samples of Die units that were repaired and constructed with Eureka Electrodes. For additional technical information write today for our illustrated catalog.

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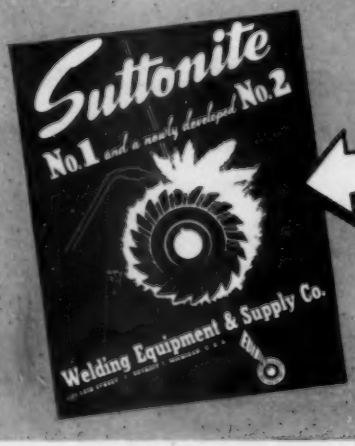

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For complete information on how to use Suttonite No. 1 and a newly developed No. 2, in your plant for the reclamation of high speed steel cutting tools, write for this folder today.

Stainless-Steel Planes

THE part which resistance welding is playing in facilitating the production of aircraft is clearly shown at Fleetwings, Inc., a division of Kaiser Cargo, Inc., where modern Army training planes are being constructed entirely of stainless steel. In

Spot welding the skin of a stainless-steel trainer plane at Fleetwings, Inc. The surface is perfectly smooth. Fittings can be made smaller and lighter because of the closer pitch permitted in spot welds.

every joint where permanency is essential, spot welding is used to integrate the sections into an inseparable one-piece structure.

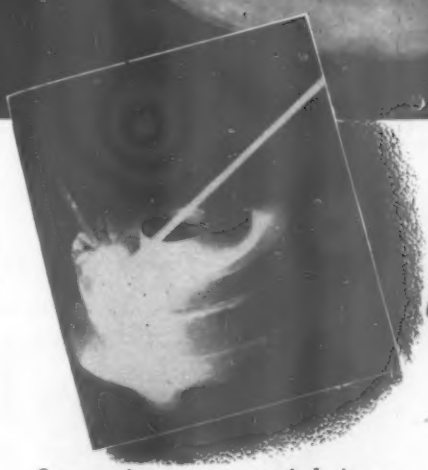
The exigencies of wartime have greatly stimulated the use of resistance welding in the fabrication of aircraft.

"The advantages of resistance welding are obvious," asserted Carl deGanahl, chief research engineer of Fleetwings. "No laying out nor drilling, dimpling or burring of rivet holes is necessary. Spot welds can be spaced at closer pitch than rivets, and there is no line of holes to weaken the metal. Spot welding, a single operation, is also faster than riveting."

Even the tiniest projection from the surface of an airplane is sufficient obstacle to the free flow of air to interfere to some extent with speed and so increase fuel consumption. Spot welding greatly lessens this sort of drag on air-flow. As shown in the accompanying illustration, the skin is left perfectly smooth, allowing an unobstructed flow of air over the surface of the craft. Paradoxically, resistance welding eliminates the resistance!

In the construction of the amphibious *Seabird*, also a stainless steel plane, Fleetwings employs seam welding. This type of welding makes an ideal joint to use in the construction of aircraft that must take to water. Seam welds are inherently watertight. Riveted joints, on the contrary, must be rendered leakproof with a preparation of tar tape bitumastic, which is not required for seam-welded joints.

PROTECT YOUR WORKERS' EYES WITH AO NOVIWELD-DIDYMIUM GLASS



Compare these two unretouched pictures. The one at the top, taken through Noviweld-Didymium, shows how these remarkable lenses give a welder a clearer view of his work, let him do a better job and increase his output.

The bottom picture is taken through standard welding glass.

Speed up Your Production ... Reduce Costs

AO Noviweld-Didymium Lenses enable the welder to look right through cloudy yellow sodium flare, and see the rod and molten area clearly with full protection against the dangerous hazards of ultra-violet and infra-red rays.

Because he is able to lay cleaner beads, the cost of secondary operations—grinding, chipping and wire brushing—is reduced to a minimum.

Right now, you can get immediate delivery of Noviweld-Didymium for the welding goggles of *all* of your operators in shade numbers 3, 4, 5, and 6. Phone or write your nearest AO Branch Office.

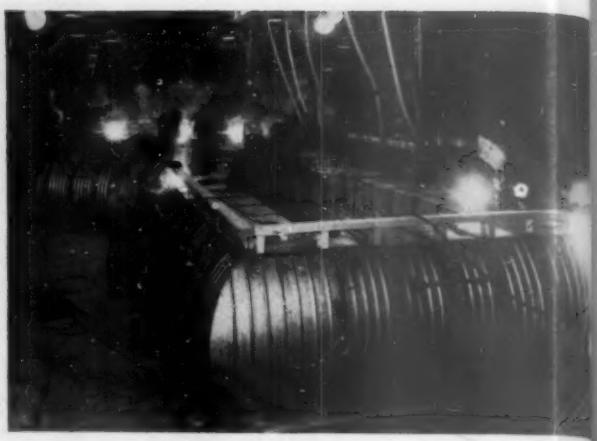
American Optical

COMPANY

SOUTHBRIDGE, MASSACHUSETTS

"Luxury" Life Raft

TORPEDOED seamen can live in comparative luxury on a new type of life raft now being fabricated by the L. A. Young Spring & Wire Corp., Oakland, Calif. Large, comfortable and seaworthy, this raft can sustain its occupants for many weeks. It has a sail to take advantage of the wind and side curtains and a canopy which can completely enclose it during bad weather. Two canvas berths are provided between the seats. The equipment includes a Bible, playing cards, cigarettes, food and water, candy, medical supplies, fishing kit, bucket, signal flares, compass, charts, hatchet, matches, illuminating lantern—just about everything you can imagine might be needed, and all of it stored snugly in watertight compartments.



This new raft goes far to alleviate the sufferings of shipwrecked fighting men. Its prefabricated sections are welded and then joined by welding on the production line.

Courtesy, Harnischfeger Corp.

Welding was the only method of metal fabrication that had the required strength to meet the brutal Coast Guard Tests which each raft must pass before acceptance. In one of these tests, the "drop test," the raft has to withstand three different drops into the water from a 45 ft height—flat, on one end and on one side. That is *some* test considering that the raft is 16 ft long and weighs 1,050 lb when fully provisioned.

Arc welding is enabling the L. A. Young Corp. to produce these much needed "luxury" rafts in amazingly quick time. Each of the raft's 28 airtight sections is prefabricated in a welding booth. From the welding booths, the parts converge to a central assembly line where they are rapidly welded into a complete craft.

» «

Relined Steam Cooker

By Randolph Mockbee

A LARGE steam-jacketed cooker had become badly rusted and was causing discoloration of its contents. The contamination of the cooked material was eliminated, however, by the welded installation of a liner of 16 gauge stainless steel.

In order to minimize loss of heat transfer, the lining was installed in 12 in. strips.

Two adjustable expanding bands hold the strips of stainless steel in place as Mr. Mockbee welds a seam of this cooker liner.

Courtesy, The Hobart Brothers Co.

for the Close Regulation that arc welding requires

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These Hobart Engine-Driven Welders are precisely and dependably regulated by Pierce Flyball Governors

● Many of the most widely used engine-driven arc welders have Pierce Flyball Governors as original equipment. Why? Because the power-units require governing that is instantly responsive—and Pierce Governors can be fully depended upon to give just that kind of close, sensitive regulation.

Through application of the time-proved principle of centrifugal action, Pierce Flyball Governors compensate on the split-second to changes in engine load. Pierce-governed units achieve complete recovery of current characteristics in as little as three-tenths of a second after the arc is struck. And the governors serve dependably for years—often for longer than the engines themselves.

Specify Pierce Governors for the new engine-driven welders you will buy—and if your present equipment is not now Pierce-governed, write for the new Pierce catalog.

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Quality control of castings and weldments is easy, fast and absolute with x-ray inspection.

For example, suppose you have a casting that must be perfected before large scale pourings are practical. All you have to do to perfect quality is make small test casts—x-ray them—and you have an easy-to-analyze picture that shows up such variables as temperature of pour, location of gates and risers, ramming and shrinking.

Once perfected, an occasional x-ray is all that is necessary to maintain quality control—for there is no need for routine examination of every piece. Workmen learn quickly and pictorially the advantages and disadvantages of each modification in metal working procedures. And you make each test of quality absolutely —nondestructively.

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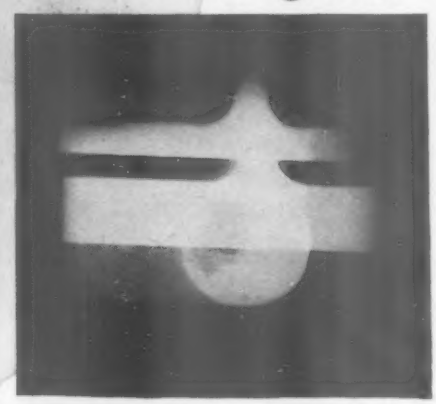
X-ray is at work on hundreds of war jobs—saving machine and man-hours, conserving critical materials, speeding production, controlling quality and helping train workers. For more information, write for B-3159. It's a simplified booklet that shows you how and where x-ray can be used in industry. J-02024

LOOK INSIDE WITH (W) X-RAY



This radiograph shows a blowhole in an aircraft casting . . . a typical example of how x-ray reveals subsurface defects.

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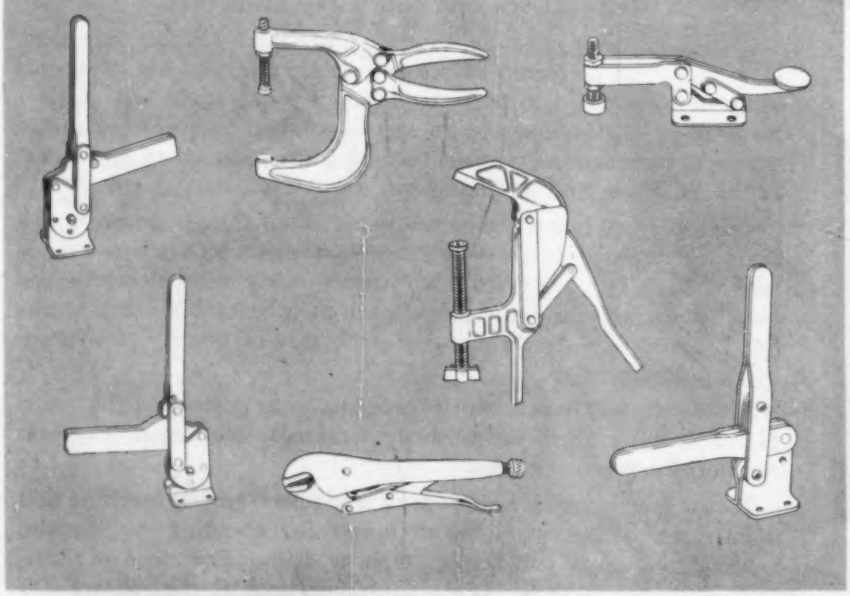
Here at Knu-Vise you will find a most comprehensive range of standard clamping devices—clamps, pliers, vise wrenches—ready for immediate delivery. However, if your production involves a different clamping application, we'll gladly develop a special clamp to meet your needs.

Remember, all Knu-Vise clamping devices can be gripped in an instant and released just as speedily—because of their unique toggle-action.

The accompanying illustration shows only a few of the models—send for a complete catalog—just off the press.



KNU-VISE INCORPORATED

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which were tightly expanded against the inner face of the tank by means of two ¼ in. steel bands equipped with turnbuckles. The two steel bands (see picture) clamped each strip snugly to the wall of the cooker and held it firmly in place during the welding. As each strip was installed, it was bonded to the inside of the tank by welding along the edge with ⅛ in. stainless-steel electrodes. Successive strips were installed in the same manner, and any open spaces at the seams were filled in completely.

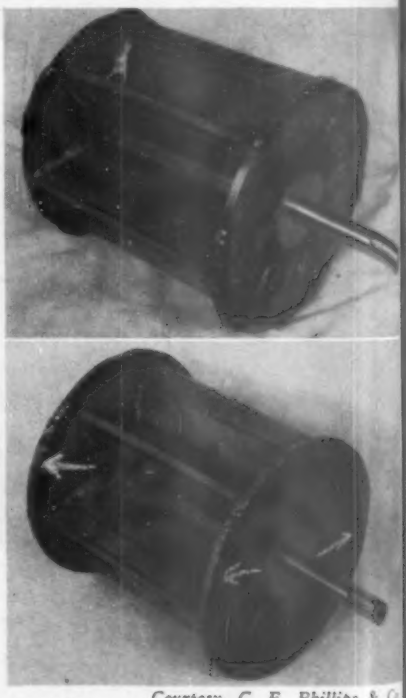
The vessel has been back in service for some little time. Though its heat transfer rate has been decreased by approximately 20%, this has not seriously hampered our particular process as we are still using the same steam pressure as before.

» «

Cast-Iron Build-up

EDGES of the head plates of a cast-iron feeding drum were so worn that the drum was no longer fit for service (top illustration). Someone then remembered that an identical drum had been repaired a year previously by the addition of new metal. The requirements were that the deposits would be easily machinable through the line of fusion and that their application would not cause distortion.

This job was done without any preheating, using 1/8 in. cast-iron electrodes. Multiple-layer deposits were made to build up pads 3/16 in. high and 5/16 in. wide on both rims. The multiple layers imparted an annealing effect to the fusion zone, thereby assuring full machinability. Distortion was prevented by alternating short deposits about 1 to 1½ in., at opposite points along the rim. This procedure equalized the distribution of heat and prevented any portion from absorbing too much heat at one time.

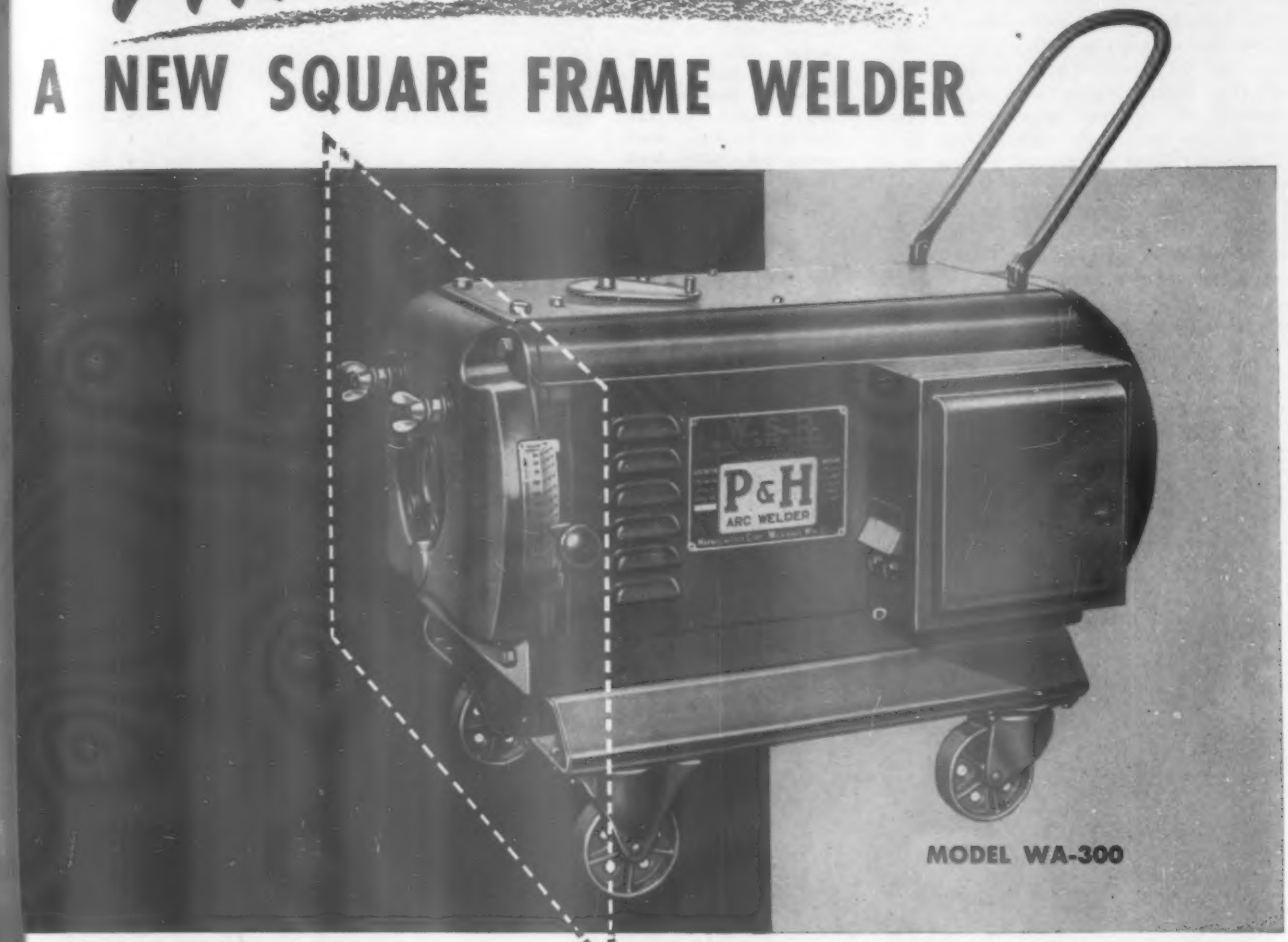


Courtesy, C. E. Phillips & Co.

How the worn edges of a cast-iron feeding drum were repaired by adding new metal. Top picture shows the job about half completed; lower picture the casting completely built up and ready for machining to dimensions.

ANNOUNCING

A NEW SQUARE FRAME WELDER



MODEL WA-300

with WSR (WELDING SERVICE RANGE) from 60 to 375 amperes

NOW—all the unique advantages of P&H's Square Frame design (and some new ones, too!) are brought to you in a welder of larger capacity.

Here are a few important operating advantages:

- SIMPLE SQUARE FRAME DESIGN — with but two major parts.
- PARALLEL OPERATION — dual mounting of machines enables you to handle higher amperage needs.
- POLARITY REVERSING SWITCH
- REMOVABLE STATOR — for easier inspection and servicing.
- CONTACT OVERLOAD PROTECTION
- MAGNETIC STARTER — with low voltage and overload protection.
- WEATHER-PROOF CONSTRUCTION

A single control provides any desired welding heat within the machine's capacity. WSR (Welding Service Range) ratings give you the actual usable welding current the machine will deliver from minimum to maximum. "Visi-matic" calibration enables you to select, instantly, the right current for each of the three classes of electrodes—high, medium, or low voltage.

If your work falls within a range of 60 to 375 amperes, it will pay you to get all the facts about this new P&H Model WA-300. Write for Bulletin No. W-59.

General Offices: 4513 W. National Ave., Milwaukee 14, Wis.

A COMPLETE ARC WELDING SERVICE

AC WELDERS

WELDING ELECTRODES

WELDING POSITIONERS

WELDING PRODUCTION CONTROL SYSTEMS

ELECTRIC HOISTS

P&H ARC WELDERS

HARNISCHFEGER CORPORATION

WELDING ELECTRODES · MOTORS · HOISTS · P&H · ELECTRIC CRANES · ARC WELDERS · EXCAVATORS

Canadian Distribution:—Canadian Fairbanks—Morse Company, Ltd.

Plane Preoiling Unit

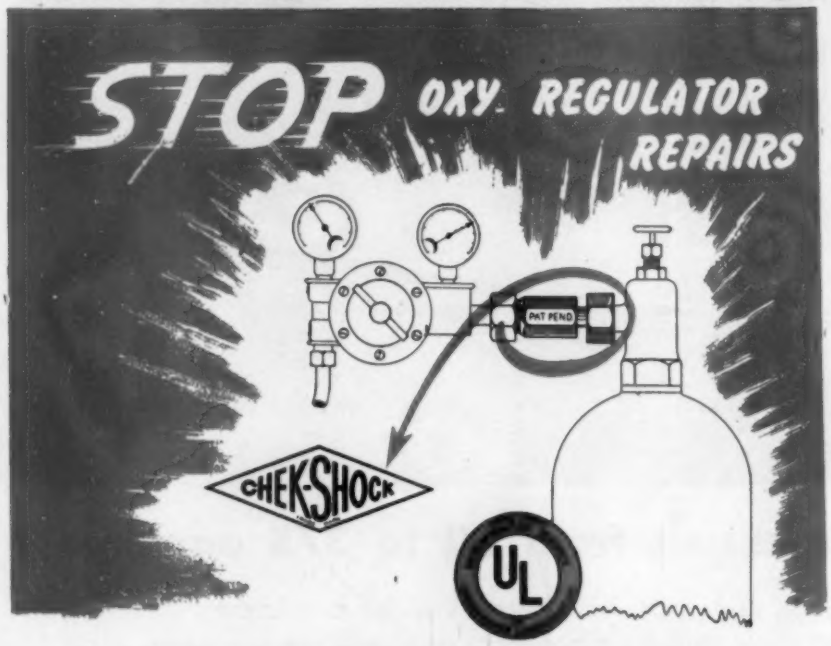
SGT. Andrew J. Reubens, 1853 Jefferson St., Muskegon, Mich., is now chief of a welding shop in a large air depot group of the Far East Air Forces in New Guinea. The accompanying picture shows a preoiling unit which was built by S/Sgt. Reubens and his squadron to force oil throughout the airplane engine. This unit cuts the "wearing in" or preoiling period of a newly overhauled (or new) engine from 45 to 5 minutes. As it assures oil getting to all parts, it is more efficient and thorough.

"I wish to commend the initiative and ingenuity in constructing a preoiling unit," wrote the depot commander. "The example set by these men in the engineering and welding departments will serve as an inspiration to all officers and enlisted men."

A successful preoiler for airplane engines was built by these men in the Far East Air Forces in New Guinea. Left to right: M/Sgt. Alden C. Finnie, Scituate, Mass.; S/Sgt. Andrew J. Reubens, Muskegon, Mich.; S/Sgt. Russell D. Roberts, Montpelier, Ind.; T/Sgt. Jacob Klundt, Grafton, Neb.; Cpl. Elmer A. Manning, Fairfield, Ia.

Official Photo, U. S. Army Air Forces

This DANGER NEVER WARNS!



— CHEK-SHOCK Oxygen CUSHION Valve —

- Will allow tank valve to be opened rapidly without damage to regulator or danger to operator.
- Will prevent unnecessary internal wear in regulator *(as,* NOT *necessary to release control screw before opening tank valve).*
- Will eliminate possible injury to operator from burstings.
- Will increase life of regulator assembly.

This NEW automatic safety device CUSHIONS the initial BLAST of pressure when tank valve is turned on *(this uncontrolled surge which strikes like a hammer, is the direct cause of most damaged regulators and accidents).* Thereafter pressure slowly equalizes and then CHEK-SHOCK allows a full flow of oxygen.

ONLY ONE MOVING PART, POSITIVELY FOOLPROOF

PRICE IS LESS THAN ONE REPAIR BILL

Coupler type (will fit any std. size welding type oxygen regulator)	$6.00 ea.
Type "A" (for small Airplane or Soldering type regulators)	6.00 ea.
Also made for all types of couplings to fit *MEDICAL* regulators	7.00 ea.

See your distributor or write—

Safety Shock Manufacturing Co.
FOWLER, CALIFORNIA

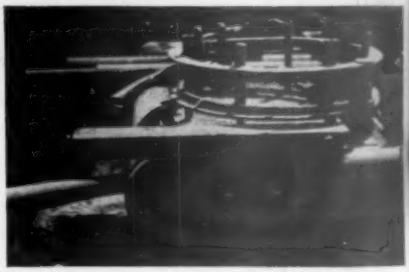
In civilian life, S/Sgt. Reubens was employed as a weldor by the Edward G. Budd Mfg. Co. in Detroit. He wears the Asiatic-Pacific Ribbon with bronze star for the New Guinea Campaign, the Good Conduct Medal, the Engineering Sleeve patch and three overseas stripes.

» «

Service Truck Anvil

By Charles C. Lynde

TO MEET the need for an anvil on jobs tackled by a service truck, a weldor of the Ray L. Smith Construction Co. made one from a short section of salvaged railroad rail. The anvil is attached to the truck so



This anvil was made from a section of old railroad rail. It can be used as a ground for arc welding.

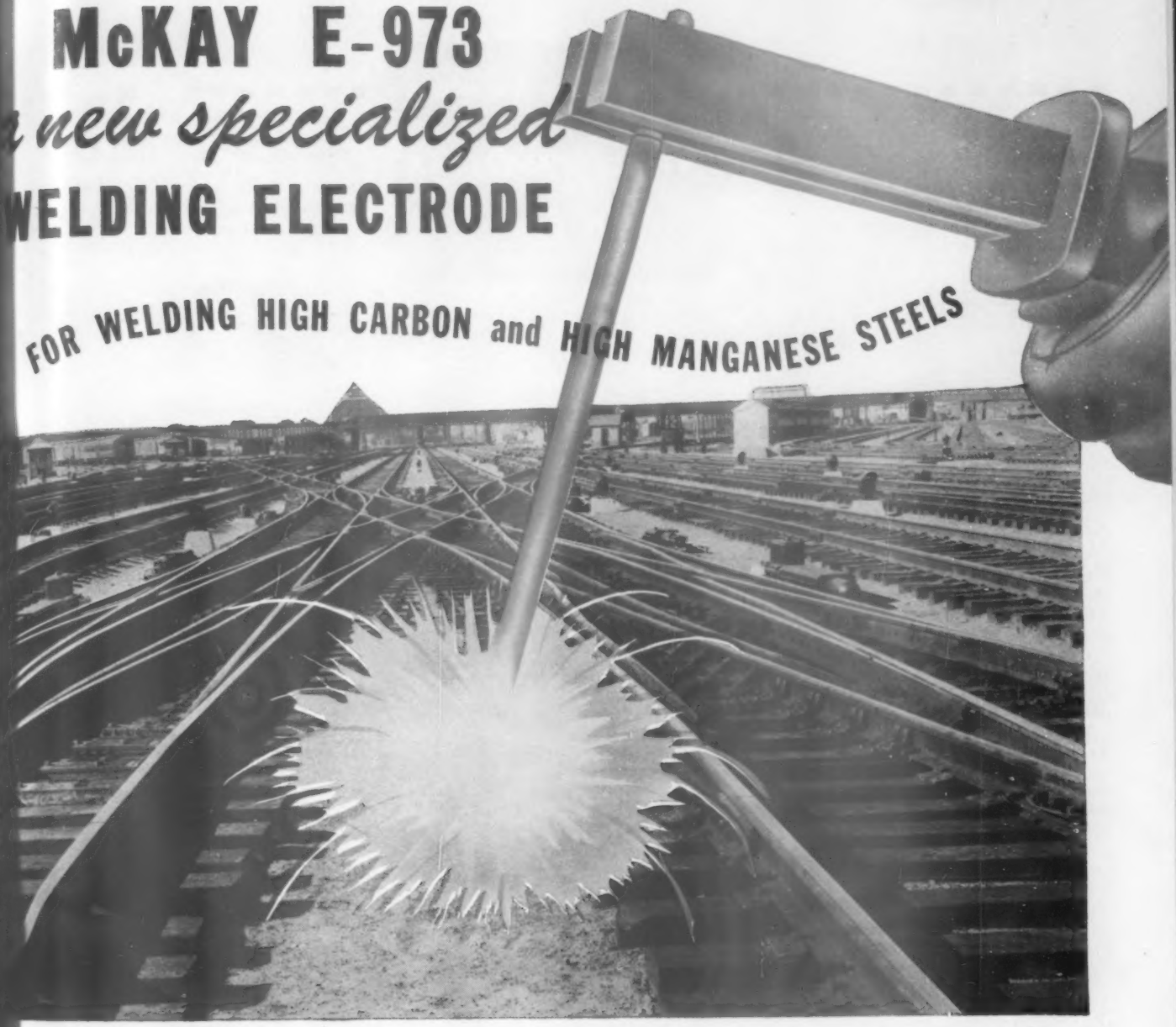
that one end extends some 10 in. over the end bumper. The rail is welded intermittently, but sufficient metal is used to insure rigidity under heavy pounding on the overhanging end.

The anvil presents a long, flat surface for straightening and aligning work and also provides a straight-edge over which light plates can be bent to form an angle. The fishplate bolt holes at the end of the rail (opposite end from overhanging section) can be used to hold a bar when it is bent into a short hook.

Using C-clamps with the anvil as a backup block, one man can frequently weld up jobs which would ordinarily require a helper. Finally, the piece of rail serves as a handy ground when arc welding is being done. The stationary cable is simply clamped to the web or a pin is thrust through one of the bolt holes and allowed to lock itself there through the pull of its own weight against the walls of the opening.

McKAY E-973
a new specialized
WELDING ELECTRODE

FOR WELDING HIGH CARBON and HIGH MANGANESE STEELS



Now you can have a *better* welding electrode . . . one that *lasts longer* and is *easier to apply* . . . for building up or otherwise welding high carbon and/or high manganese steels!

McKAY E-973 is specially made for the job. The weld metal will not cross check or crack under the deposit. Although soft in the "as welded" state, it work hardens rapidly . . . permitting heavy pads to be built up without danger of mushing down, cracking loose, spalling or flaking when subjected to constant wear and service. Exceptionally smooth flowing properties make it unusually easy to apply. It does not require pre-heating or frequent delay for peening.

McKAY E-973 is the result of intensive research and service testing. It was specially developed for railway use but has wide application in other industries where welding of comparable steel is involved . . . effective demonstration of the McKAY policy of manufacturing electrodes to meet *specific needs.*

Write today for full information.

GENERAL SALES OFFICES: YORK, PA.

THE McKAY COMPANY
PITTSBURGH, PA.

WELDING ELECTRODES . . . COMMERCIAL CHAINS . . . TIRE CHAINS

New Products to Use

Polishing Wheels

★ **Norton Co.**, Worcester, Mass., announces a line of solid polishing wheels which are to be marketed under the trade name "Norflex." They are avail-

"Norflex" polishing wheels. Left to right: cork resinoid, fibre resinoid and resilient rubber wheels.

able in three types: cork resinoid, fibre resinoid and resilient rubber. All three types are similar in that they possess a relatively soft and flexible bond. They differ from conventional grinding wheels in that they are designed to remove only a small amount of material, such as a burr or a sharp edge, or to polish a surface that has already been brought to size.

The fibre resinoid type consists of uniformly sized abrasive grains mixed with cotton fibres and held together with a resinoid bond. This mixture is then pressed to the desired size of wheel or stick.

Wheels of the resilient rubber type are made with a comparatively soft rubber bond, which imparts a cushionlike cutting action. The cork resinoid wheels are made up of abrasive, resinoid bond and finely divided cork, the latter providing a soft polishing action.

» «

Processed Cover Glasses

★ "Ipco" processed cover glasses for welding shields are regular 2 by 4⅛ in. glasses that have been treated with a

"Ipco" welding-shield cover glasses are processed to withstand heat and spatter.

protective coating to guard against heat breakage and damage from metal spatter. Glasses are covered on both sides with baked-on protective coating which, states manufacturer, will not pit, peel nor rub off. These glasses, it is claimed, will save many minutes per worker a day of time that is ordinarily required for the replacement of broken and pitted glasses. **Industrial Products Co.**, 2802 N. Fourth St., Philadelphia 33.

» «

Inspection Magnifier

★ The Magni-Ray Model "C" is an illuminated magnifier especially de-

Model "C" Magni-Ray. It has a 5 in. lens of optical glass and two 4 in. tubular bulbs.

signed for use on large castings for the detection of cracks, blowholes and other imperfections. It may also be employed for examining welds, for the inspection of ground, polished or lapped surfaces or for the assembly of small and delicate mechanisms. The lens, 5 in. in diameter, is made of high-grade optical glass and gives a clear, undistorted vision of the object. A universal clamping device, permitting swiveling both up and down and sideways, is used to fasten the lens housing to the 16 in. vertical rod extending from the triangular cast-iron base. Each magnifier is equipped with two 25 watt tubular bulbs, 4 in. long, which are especially silvered so that the light will be reflected directly upon the work without loss of candlepower. A deep-green background on the base minimizes eyestrain and adds to the ease of inspection. **George Scherr Co., Inc.**, 200 Lafayette St., New York City 12.

"Snap-Fast" Face Shield

★ A new "snap-fast" face shield that makes possible visor replacement in 15 seconds is announced by the **Chicago Eye Shield Co.**, 2300 Warren Blvd.,

"CESCO" face shield. It's a snap to change.

Chicago 12. Perforations in the visor fit snugly over small lugs. Spring clamps at each end hold the visor firmly in place. A turn of the fingers snaps out the old visor, permitting the new one to be quickly slipped into position. The ease of visor replacement is said to be especially desirable when face shields are used in flash and butt welding, spot welding, heavy grinding and similar operations.

Visor is of tough, non-inflamable plastacele. It fits snugly against the chest to prevent the entrance of flying particles from below and is quickly adjusted to rest easily on the head.

These shields are available in four styles, including one with open-top headgear, one with half-crown headgear and another with helmet top and bottom guards. Buyer also has choice of two visor thicknesses.

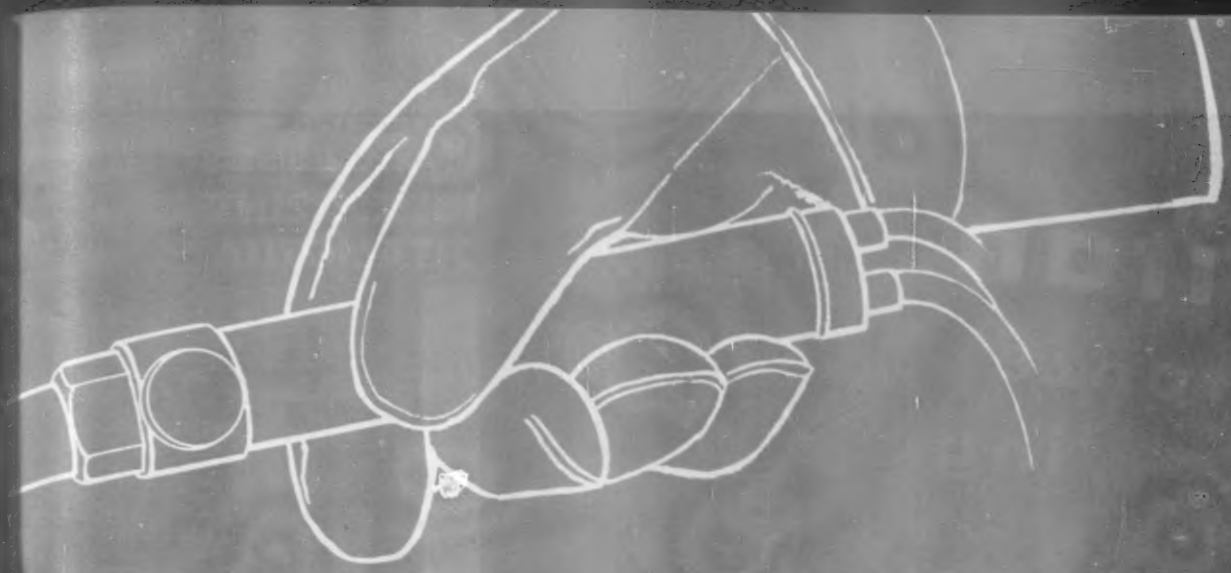
» «

Keller pneumatic screw-machine drill for accuracy and high speed.

Air Drills

★ A new line of air drills for use on hand and automatic screw machines is announced by the **Keller Tool Co.**, Grand Haven, Mich. These drills may be mounted in the regular tool holders of the screw machines. Compressed air is fed to the drill through a valve arrangement which opens as the turret moves forward and closes immediately when the turret is backed away from the work.

Annual Directory of Welding Products — coming in THE WELDING ENGINEER for March!



..and here is WHY you should send for it TODAY!

EUTECTIC *Low Temperature* Welding is NEW! It is one of the most *revolutionary welding developments* of modern times and *The Eutectic Welder* is the only publication that tells you all about it.

Welding at temperatures below the fusion point of base metals is made possible by employing the phenomenon of surface alloying. Joints welded with EUTECTIC *Low Temperature* Welding Rods are *smoother, stronger, better color matched* and *more machinable* than those obtainable *by any other welding or brazing process.*

All metals can be joined by EUTECTIC *Low Temperature* Welding. No special skill is required. All standard methods of heating are employed: gas—arc—furnace and others.

Be the first to introduce the EUTECTIC *Low Temperature* Welding process and its great advantages into your company. Write for *your* copy of *The Eutectic Welder* TODAY! Fill in and mail the coupon or write on your company letterhead and your copy will be sent FREE by return mail. Thereafter you will receive it regularly every month.

The Eutectic Welder is published by the Engineering and Research staff of the Eutectic Welding Alloys Company and is supplemented by valuable contributions from enthusiastic users in all fields of industry and manufacturing.

SENT FREE ON REQUEST

Low Temperature
WELDING RODS

EUTECTIC WELDING ALLOYS COMPANY
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Please send me latest issue of *The Eutectic Welder* and place my name on your regular mailing list.

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Company..... **Position**.....

Address.....

City.....

★Superior welds can be obtained by selecting the welding alloy containing those properties best suited to each particular application.

Titan Bronze Welding Rods are double deoxidized to remove all occluded and dissolved gases picked up in melting, increasing ductility and reducing fuming to a minimum. They may be obtained in the following grades:

GROUP I—General purpose rods particularly recommended where high strength and ductile welds are required.
PENN BRONZE—Flows at 1628°F.
TITAN BRAZING BRONZE—Flows at 1625°F.

GROUP II—Manganese bronze rods for higher physical properties. General purpose rods recommended for Cast Iron, Cast Steel, other ferrous and some non-ferrous alloys.
TITAN MANGANESE BRONZE—Flows at 1617°F.
TITAN NAVAL MANGANESE BRONZE—Flows at 1620°F.

GROUP III—Tin Bronze rods that work very well on cast iron, as well as on other ferrous and some non-ferrous alloys. The welds have good corrosion resistance.
TITAN BRONZE—Flows at 1617°F.
TITAN NAVAL BRONZE—Flows at 1615°F.
TITAN WEARWELL—Flows at 1593°F

WRITE FOR COMPLETE INFORMATION

Titan

METAL MANUFACTURING CO., BELLEFONTE, PA.
NEW YORK • CHICAGO • SAN FRANCISCO

Quality Alloys By Brass Specialists
Brass and Bronze Rod • Forgings • Die Castings • Welding Rods

Crane Truck

★ Model L-11C combination crane truck announced by **The Elwell-Parker Electric Co.**, 4205 St. Clair Ave., Cleveland 14, is said to have improved operating

Elwell-Parker Model L-11C truck combination. It will serve as a lift-truck, a crane, a load carrier or a tractor.

characteristics because of the addition of a separate motor for raising and lowering the boom. In previous models a single motor served to raise and lower both boom and hook.

The new model crane truck is a four-way truck, serving the purposes of a lift-truck, a load carrier, a crane and a tractor. It loads itself either by picking up skid loads with the lift platform or by lifting heavy parts and placing them on the platform for transport. As a tractor, it pulls trailer cars, which may be loaded by means of the crane. This model has a capacity of 6,000 lb on the platform, 2,000 lb on the hook at 42 in. radius and 1,000 lb on the hook at 84 in. radius. Under normal conditions, it will travel at 6 mph with no load and 5 mph with full load.

» «

All-Purpose Conveyor

★ The "Tote-All" is a lightweight, portable endless-belt conveyor that is said to

"Tote-All" conveyor. For use wherever a lightweight, endless-belt motor- or engine-driven conveyor is needed.

be efficient for many different types of industry. It is available in two lengths —13 ft 9 in. and 20 ft—and may be driven by either an electric motor or a gasoline engine (1½ hp or 2.3 hp for heavy-duty work). The normal belt speed is 420 fpm, and a variable-speed drive pulley is available if desired. **Coaltoter Conveyor Co.**, 310 S. Michigan Ave., Chicago 4.

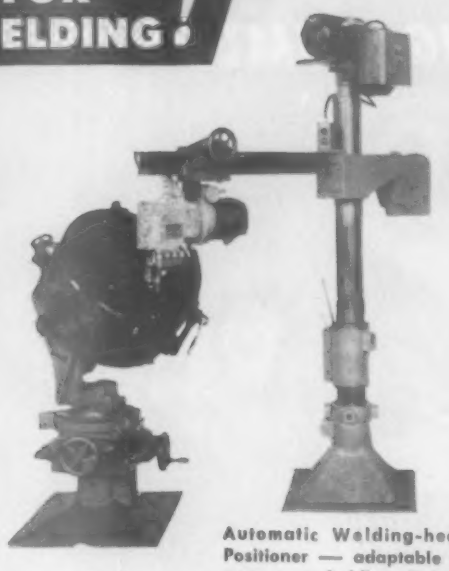
See THIS FIXTURE FOR AUTOMATIC WELDING!

A BIG TIME SAVER!

THIS Acme dual fixture arrangement permits practically constant use of an automatic welding head, because one of the fixtures can be reloaded while the other is engaged in the welding operation.

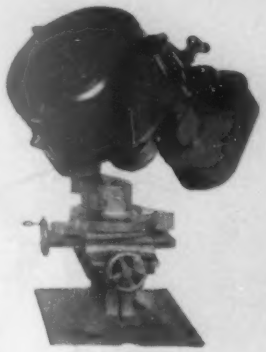
The holding machine can be set to revolve at any angle from vertical to horizontal. (Illustration shows a wheel being welded at 45° angle.) Positioner arm swings from one fixture to the other, locking in proper position. Speed of rotating the work is adjustable, as desired.

WRITE
for information relating to your particular welding fixture problem



Automatic Welding-head Positioner — adaptable to your own holding fixture.

Reloading Is Done During Welding Operation



ACME *Manufacturing Co.*
1642 HOWARD ST. • DETROIT, MICH.

TRI-FLUX
A NEW AND BETTER SOLDERING FLUX

No. 5 FOR STAINLESS AND MONEL METAL
No. 3 TRI-FLUX (Regular) FOR ALL OTHER METALS
No. 20 TRI-FLUX (Neutral) NO AFTER CORROSION

ONE APPLICATION { CLEANS / REMOVES RUST / FLUXES

TRI-FLUX is amazing in its simplicity, efficiently performs three distinct jobs and is extremely economical. Saves time and money—no waste. Truly the most etching flux ever developed. TRI-FLUX cleans, removes rust and fluxes all in one operation. TRI-FLUX made in single strength for steel, iron and other metal surfaces. TRI-FLUX No. 5 especially designed for stainless steel and monel metals.

Tri-Flux Advantages

- No need to pre-clean with acid, or oil solvent
- Sticks to wet surfaces. Can be applied without first drying surface
- Can be applied to oily surface without wiping off first
- Sticks to vertical surfaces as well as horizontal. Won't run off
- May be used for hand or torch soldering
- Saves time—one application does three jobs
- Has no injurious effect on surfaces of metals
- Economically applied—put on with brush—no waste
- Will not spoil by standing
- No disagreeable odors

Tri-Flux
"TRIPLE DUTY FLUX"

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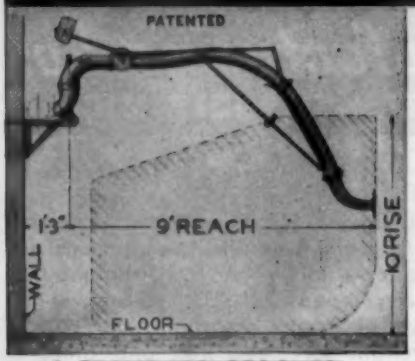
THE WOLFE-KOTE CO.
SHEBOYGAN • WISCONSIN



3 STANDARD REACHES:
3 ft., 9 ft. and 15 ft. radius. Arm extended for maximum reach. Note very wide working range.

RUEMELIN
Fume Collector
DRAWS OUT GASES, SMOKE and HEAT
at the Source!

Solve your fume problems quickly and efficiently by installing Ruemelin Fume Collectors. Powerful suction draws out noxious gases, smoke and heat at the source. Guards employee health, resulting in less welder fatigue, therefore greater plant output. Has many exclusive features: (1) Clears shop air with minimum loss of building heat. (2) Exhaust snout can be positioned instantly and conveniently. (3) Covers maximum welding territory, vertically, horizontally and by circle swing. (4) Shipped completely assembled, easy to install. Thousands of Ruemelin Fume Collectors now serving war industries everywhere.

We gladly offer engineering service for your fume collector installation. Write for Bulletin 37-C.

RUEMELIN MANUFACTURING COMPANY
3880 NORTH PALMER STREET MILWAUKEE 12, WIS., U. S. A.

RUEMELIN
SAND BLAST EQUIPMENT · TUBULAR DUST FILTERS

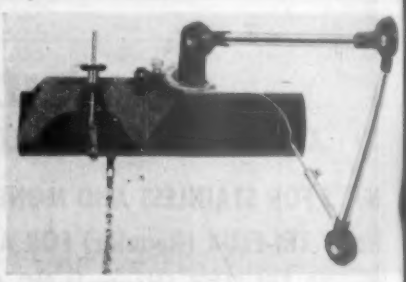
"Beanie" Caps

★ A new lightweight head protector known as a "Beanie" cap is made of molded fibre and employs a soft, flexible

"Beanie" cap, a new lightweight head protector. Lower illustration shows how the cap lining and hammock are arranged to cushion the blow.

band which fits any shaped head comfortably. The cap lining and hammock are arranged to cushion the head against injuries. Weight of the cap is approximately 6 oz. Portable Products Corp., 420 Blvd. of the Allies, Pittsburgh 19

» «



"Trumark" protractor. With this model the circumference of pipe 3 to 18 in. in diameter may be scribed at any desired angle.

Marking Protractor

★ Pipe, structural shapes and flat sheets may be scribed at any angle with the "Trumark" protractor. This device is made in two stock models, three sizes. The model illustrated scribes the circumference of pipe 3 to 18 in. in diameter. It is placed on the pipe parallel to the center line, leveled with a built-in spirit level, locked in place with a spring chain and adjusted to the desired angle by means of a 180 deg scale calibrated in intervals of one-half degree. Another size of this model marks pipe 12 to 36 in. in diameter.

The "Junior Trumark" protractor marks pipe or rod ½ in. to 3 in. in diameter. Both models can be used on flat surfaces, channels, T or I structural shapes. The protractor is set up as on pipe or held square to any edge or corner. The plumb bob indicator and the spirit level will show any degree of angle from a horizontal plane.

PRODUCTION *speeds up when welders have protective garments of flexible, heat-resistant*

LICHTMAN chrome-tanned COWHIDE

FIRST choice of manufacturers who sell you:

LICHTMAN J.L.&S. LEATHERS NEWARK, N.J. TRADE MARK

APRONS
COATS
GLOVES
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OVERALLS
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HEADGEAR
LEGGINGS
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Tanners of Quality Leathers Since 1883

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EFFICIENT

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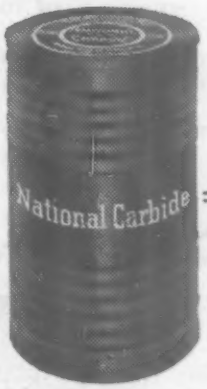

For
Welding and Cutting
Specify

NATIONAL CARBIDE IN THE RED DRUM

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NATIONAL CARBIDE CORPORATION

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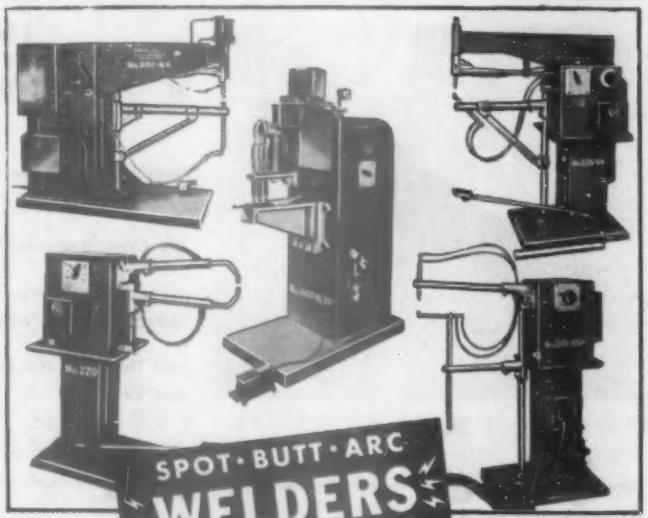

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We manufacture a complete line of resistance spot welders from ¼ to 300 KVA for all types of welding. There is an EISLER WELDER for every purpose.

TRANSFORMERS OF ALL TYPES

WE INVITE CONTRACT SPOT WELDING IN LARGE OR SMALL QUANTITIES.

CHAS. EISLER
EISLER ENGINEERING CO.

749-50 13th ST. Nr. AVON AVE. NEWARK N. J.

Temperature Indicators

★ Tempil° products are characterized by a sharp and rapid melting at a given temperature in order to show when a proper working heat has been reached. These products are a crayon, pellets and a liquid. All of these are available in intervals of 25 F from 125 to 300 F. The crayon range continues upward in 50 F intervals to 900 F, and the pellets and the liquid are also available in 50 F intervals up to 1,600 F.

"Tempil°" products for temperature indication—crayon, lacquer and pellets.

The crayon, "Tempilstik°," is recommended for welding, heat treating and metal fabrication in general. The liquid, "Tempilaq°," is useful on the interiors of tubes and other areas not conveniently accessible to the crayon or pellets, or for application on glazed and polished surfaces. The pellets are suggested for signaling temperatures of extensive areas or large units, and especially for applications where processing must be watched from some distance. **Tempil° Corp.**, 132 West 22nd St., New York City 11.

» «

Marking-Die Holder

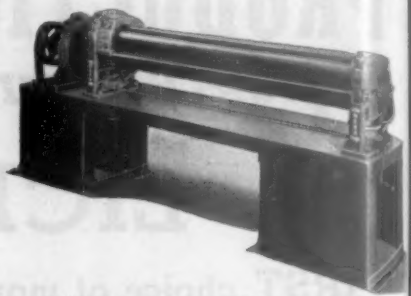
★ Many parts in the ordnance and automotive fields are too large to be conveniently handled in power-operated marking equipment. Though such parts can be marked by hand, in most instances the marking is too extensive to be placed on a single stamp and must be divided into sections, each engraved upon a separate stamp. In general, the separate stamp method of marking has been cumbersome, slow and inaccurate.

A fixture has been developed by **The Acromark Co.**, 5-7 Morrell St., Elizabeth 4, N. J., which will hold all marking dies in the exact position for stamping. Then the marking is so arranged that an impression can be made by a single hammer blow on each die.

» «

Plate Bending Roll

★ Webb Model 2-L, though primarily a bench-type plate bending roll, can be equipped with legs or a stand as pictured herewith. It is furnished in lengths of from 38 to 98 in. and in capacities from 7 to 16 gauge and thinner. This roll features the Webb totally enclosed speed-reduction unit. The top shaft is raised and lowered for removal of the cylinder, which is done by means of a hand crank at the tail end of the machine. The unit is driven by a 3 h.p. motor through a short V-belt drive. **Webb Corp.**, Webb City, Mo.

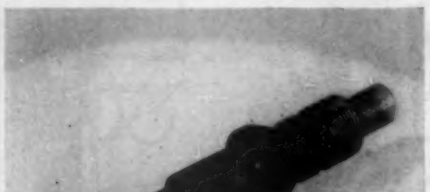


Model 2-L, newest addition to the Webb Corporation's line of plate bending rolls.

» «

Photometer

★ A new transmission photometer for accurate measurement of the amount of light transmitted through very small areas of spectrographic plates is announced by the special products division of the **General Electric Co.**, Schenectady. This device is said to be desirable for use in the metal fields wherever spectrographic analysis is employed and also for microcolorimetric and microchemical analyses and for measuring light transmission through solutions.



Before

INTRODUCING TIP CLEEN

A NEW MAGIC CLEANER FOR WELDING TORCH TIPS

Due to the extreme heat of the torch, impurities and deposits settle in the nozzle and in time clog it up.

Tip Cleen Removes these deposits Easily . . . WITHOUT HARM TO THE TIPS.

Tips already thrown into the discard because their clogged condition made cleaning seem impossible Have Been Cleaned Easily With Tip Cleen.

Just Think Of The Economy . . . Not Only In The Number Of Tips Saved But Also In Labor And Delays!

--Save--------Time--------And--------Money--

New, Simple, Easy . . . No Harm to Tips

Old methods frequently used Strong and Injurious Acids . . . Tip Cleen Is absolutely Non-injurious to the tips. Drills have been used, but they injure the passages by breaking off and by changing the tapered tolerances.

To clean Tips by this new method, merely heat Tip Cleen to 150 degrees Fahrenheit, drop in tips for four hours, remove tips and rinse in cold water. THEY WILL BE AS CLEAN AS NEW . . . No impurities will remain in the air passages . . . it will shine like a new rifle barrel.

Be Convinced At No Cost To Yourself . . . Send For A Free Sample Today.
Weight approximately 50 lbs. per shipping case. Packed in gallon containers 4 to the shipping case.

SHEBOYGAN WOLFE-KOTE CO. WISCONSIN

Makers of CORE CLEEN, CARBON CLEEN, GREASE CLEEN

After

Twist Drill Size Data

Drill sizes are in fractions of an inch, in Standard Twist Drill letters or in Standard Twist Drill numbers. In addition to showing the diameter of the drills or the orifices made by them, the table includes the cross-sectional area of the drills or orifices in square inches. This information will be useful in estimating gas flow and related data.

SIZE	DEC. EQUIV.	AREA	SIZE	DEC. EQUIV.	AREA	SIZE	DEC. EQUIV.	AREA	SIZE	DEC. EQUIV.	AREA
1/2	.500	.1964	G	.261	.0535	5/32	.1562	.0192	51	.067	.00353
31/64	.4843	.1843	F	.257	.0519	23	.154	.0186	52	.0635	.00317
15/32	.4687	.1726	E-1/4	.250	.0491	24	.152	.0181	1/16	.0625	.00307
29/64	.4531	.1612	D	.246	.0475	25	.1495	.0175	53	.0595	.00278
7/16	.4375	.1503	C	.242	.0460	26	.147	.0170	54	.055	.00242
27/64	.4218	.1396	B	.238	.0445	27	.144	.0163	55	.052	.00212
Z	.413	.1339	15/64	.2343	.0431	9/64	.1406	.0156	3/64	.0468	.00172
13/32	.4062	.1296	A	.234	.0430	28	.1405	.0155	56	.0465	.00169
Y	.404	.1282	1	.228	.0408	29	.136	.0145	57	.043	.00145
X	.397	.1238	2	.221	.0384	30	.1285	.0129	58	.042	.00138
25/64	.3906	.1201	7/32	.2187	.0376	1/8	.125	.0123	59	.041	.00132
W	.386	.1170	3	.213	.0356	31	.120	.0113	60	.040	.00126
V	.377	.1116	4	.209	.0343	32	.116	.0106	61	.039	.00119
3/8	.375	.1105	5	.2055	.0332	33	.113	.0100	62	.038	.00113
U	.368	.1064	6	.204	.0327	34	.111	.00968	63	.037	.001075
23/64	.3593	.1014	13/64	.2031	.0324	35	.110	.00950	64	.036	.001018
T	.358	.1006	7	.201	.0317	7/64	.1093	.00939	65	.035	.000962
S	.348	.0951	8	.199	.0311	36	.1065	.00890	66	.033	.000855
11/32	.3437	.0928	9	.196	.0302	37	.104	.00849	67	.032	.000842
R	.339	.0903	10	.1935	.0293	38	.1015	.00809	1/32	.0312	.000765
Q	.332	.0865	11	.191	.0286	39	.0995	.00779	68	.031	.000755
21/64	.3281	.0845	12	.189	.0280	40	.098	.00754	69	.029	.000660
P	.323	.0819	3/16	.1875	.0276	41	.096	.00724	70	.028	.000616
O	.316	.0784	13	.185	.0269	3/32	.0937	.00690	71	.026	.000531
5/16	.3125	.0767	14	.182	.0260	42	.0935	.00686	72	.025	.000491
N	.302	.0716	15	.180	.0254	43	.089	.00622	73	.024	.000452
19/64	.2968	.0693	16	.177	.0246	44	.086	.00581	74	.0225	.000398
M	.295	.0683	17	.173	.0235	45	.082	.00528	75	.021	.000346
L	.290	.0660	11/64	.1718	.0232	46	.081	.00515	76	.020	.000314
9/32	.2812	.0621	18	.1695	.0225	47	.0785	.00484	77	.018	.000254
K	.281	.0620	19	.166	.0216	5/64	.0781	.00479	78	.016	.000201
J	.277	.0603	20	.161	.0204	48	.076	.00454	1/64	.0156	.000191
I	.272	.0581	21	.159	.0198	49	.073	.00418	79	.0146	.000165
H	.266	.0556	22	.157	.0194	50	.070	.00385	80	.0135	.000143
17/64	.2656	.0554									

Table of Multipliers

Diameter of a circle × 3.1416 = Circumference.
Radius of a circle × 6.283185 = Circumference.
Square of the radius of a circle × 3.1416 = Area.
Square of the diameter of a circle × 0.7854 = Area.
Square of the circumference of a circle × 0.07958 = Area.
Half the circumference of a circle × half its diameter = Area.
Circumference of a circle × 0.159155 = Radius.
Square root of the area of a circle × 0.56419 = Radius.
Circumference of a circle × 0.31831 = Diameter.
Square root of the area of a circle × 1.12838 = Diameter.
Diameter of a circle × 0.866 = Side of an inscribed equilateral triangle.
Diameter of a circle × 0.7071 = Side of an inscribed square.
Circumference of a circle × 0.225 = Side of an inscribed square.
Circumference of a circle × 0.282 = Side of an equal square.
Diameter of a circle × 0.8862 = Side of an equal square.

The Technical Slant

Design

PRACTICAL DESIGN FOR ARC WELDING, *Vol. 2. By Robert E. Kinkead. Published by The Hobart Brothers Co., Troy 1, O., 1944. Cloth bound;* 8¾x11½ in.; *212 pages. Price $3.50.*

Taking up where the first volume left off, the second volume of "Practical Design for Arc Welding" presents 100 new and entirely different "idea stimulators" for use by designers, engineers, and fabricators.

To select the 100 design ideas for this second book, Mr. Kinkead was forced to pay considerable attention to the fabrication of tubular members and connections. Many of the ideas he presents will be found applicable both to piping installations and to tubular structural design. All in all, the second book well merits the same acclaim that is deservedly being given to the first volume of the Design for Arc Welding series.

» «

Tube Data

SEAMLESS TUBE DATA BOOK. *Published by Seamless Steel Tube Institute, Pittsburgh 19, 1944. Loose-Leaf Binder;* 8½ x 11 in; *320 pages. Price $2.50.*

Its publisher promises that this reference work on seamless tubing will be kept up-to-date by supplementary sheets of new data, which will be supplied purchasers from time to time. As it stands now, the volume is divided into four distinct sections: general data, mechanical tubing, pressure tubing and reference tables.

The first section briefly summarizes the history and manufacture of seamless tubing and gives data on shapes, composition, mill practices and similar information.

The section on mechanical tubing contains data on typical uses, suggestions on how to obtain best results through the use of tubing, the method of determining the proper size. Complete tolerance tables, properties for beams and a digest of standard specifications are also given.

In the pressure tubing section are various pressure formulae, specifications and tolerance tables for boiler tubes, heat exchanger and condenser tubing, still tubes, alloy steel pipe. Stainless steel analyses are included together with metallurgical data.

The unusually extensive reference tables contain many formulae; weight tables for rounds, squares, rectangles; surface areas both inside and outside, and other tables commonly found useful in tubing applications.

» «

Aircraft

AIRCRAFT SHEET-METAL BLUEPRINT READING. *By Harry H. Coxen, Gerald E. Jackson, and Gilbert D. Masters. Published by American Technical Society, Chicago, 1944. Spiral bound, paper;* 8½x11 in.; *132 pages. Price $2.50.*

The authors have endeavored to pack into a single volume all the material suitable for training the new worker in the aircraft sheet-metal shop so that he will be able to read blueprints and to make his own layouts therefrom. The volume opens with a glossary of the common terms used in sheet-metal work, terms frequently appearing on blueprints. This is followed by a complete list of the abbreviations used in aircraft production. For the novices, there is also a brief summary of arithmetic problems and mechanical drawing principles.

Actual practice in blueprint reading can be obtained from some 25 blueprints that are included as part of the text. These give the student the opportunity to examine the drawing closely and at his leisure and then to check his ability to read blueprints by answering a series of test questions. There are questions pertaining to each of the prints reproduced.

Differing from many books previously written on blueprint reading, the new volume was not laid out with the thought of teaching the student how to draw but merely to teach him how to read a blueprint. With this thought in mind, the book becomes an excellent source of information.

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Incentives

WAGE INCENTIVES. *By J. K. Louden. Published by John Wiley & Sons, New York, 1944. Cloth, 5¼ x 8½ in.; 174 pages. Price $2.50.*

This book makes an effort to plead the cause of wage incentives by telling their story in a balanced, unbiased manner. It was written primarily for the man of management and the man of labor rather than for the engineer.

Rather than to review the many ramifications of various incentive plans and their uses, the author has chosen to avoid excessive details and hew to a straight line emphasizing policies, relationships, control and the like. He is of the opinion that these have been less understood and appreciated than the technical details of the various incentive plans.

If you, as a reader, do not agree with our answers, let us know your thoughts. Your comments and discussions will be published, too.

Arc Length Effect

Q—I know the length of the arc in arc welding will cause variations in the arc voltage. Does any other effect result from changing the length of the arc?—*G. Q.*

A—The length of the arc will effect the quality of deposited weld metal. Too short an arc may result in undistributed porosity in the weld, while a longer arc means longer exposure of the arcing metallic globules to the harmful effects of the nitrogen and oxygen in the atmosphere. Too long an arc presents the additional likelihood that the weld metal may be deposited on the work surface without the proper penetration needed for fusion. Also, when the arc is too long it is difficult to concentrate the heat on the work, and so more heat is allowed to escape in space. Finally, the long arc is inclined to result in wild action on the part of the welding electrode.

» «

Electrical Shock

Q—Much has been sajd about the danger of shock when using an a-c welder. What is the truth about this?—*C. B. H.*

A—Naturally there is danger of shock with both an a-c welder and a d-c welder —just as there is danger of shock with any electrical device if it is not used with caution. The danger of shock with either a-c or d-c welders is very small, however, providing that moderate care is taken by the man working with such equipment.

Safety records indicate that, next to drowning, electrical shock has been the least frequent cause of industrial fatality among groups of men who sometimes or often handle electrical equipment.

» «

Carbo-Hydrogen Gas

Q—What is carbo-hydrogen gas?—*M. H. W.*

A—"Carbo-hydrogen" is a trade name for a gas very similar to hydrogen which is used for flame-cutting operations. It is made by a cracking process in which oil is dropped on a brickwork heated to a red heat. This produces a gas mixture of approximately 85% hydrogen, 3% carbon monoxide and 12% methane. When burned with oxygen, carbo-hydrogen produces a flame temperature of approximately 4,900 F.

» «

Machine Efficiency

Q—What is meant by the efficiency of a machine?—*M. A.*

A—Machine efficiency is the ratio of the amount of power or work obtained from a machine to the amount of power that is required to operate it.

... Where She Stops Nobody Knows ...
YOUR NEXT WELDING JOB
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STAINLESS STEEL
COPPER
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You're a winner every time with this handy Weld-All Electrode Kit no matter what the job. It contains the right rod for every welding job . . . every rod a leader in its class! You'll get maximum returns from your welding equipment with these scientifically engineered rods. Each type is specially designed to meet the exact requirements of its particular kind of welding.
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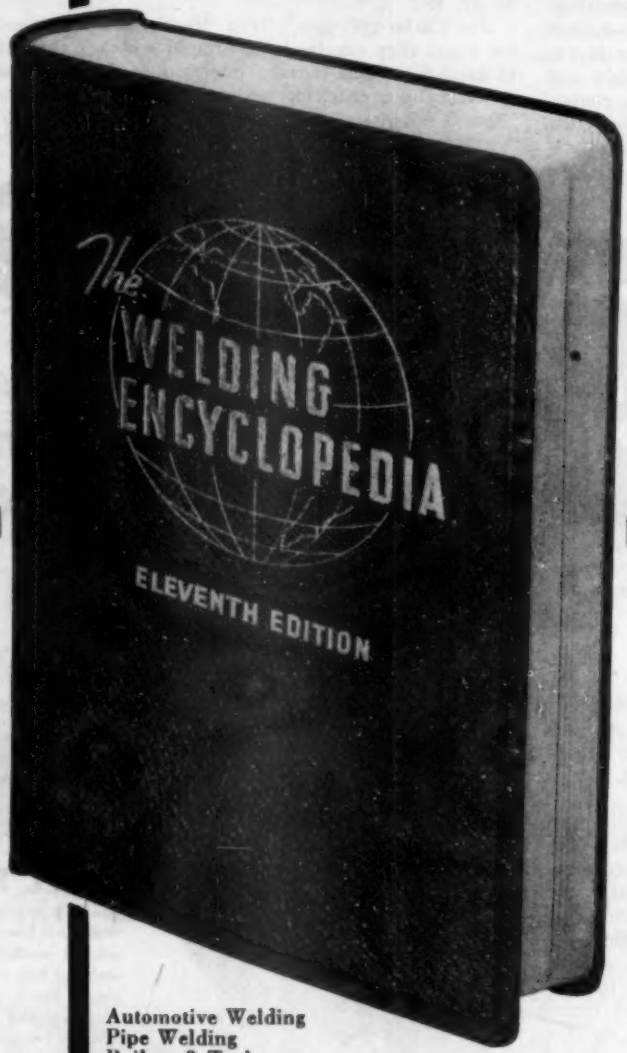

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C-F POSITIONERS

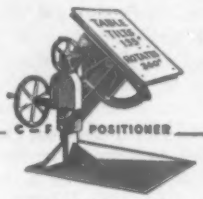
Save 72 Lifts

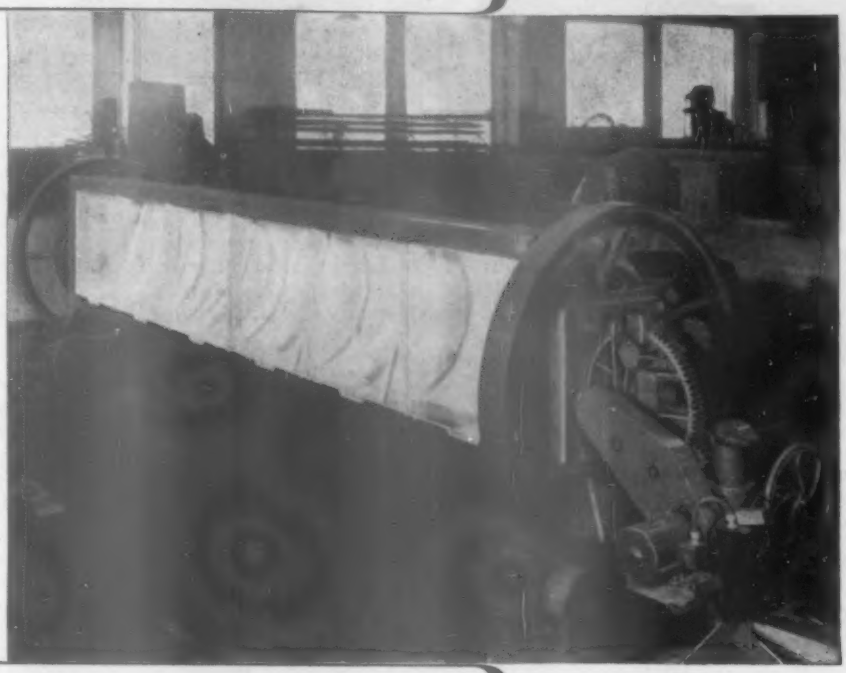
The Nordberg Manufacturing Co., Milwaukee have eliminated 72 lifts per unit by using a C-F Positioner on the production job illustrated. These complex weldments (Scavenging air headers for large Diesel engines) have to be "procedure-welded" and formerly required 72 crane lifts which took an average of 20 minutes apiece.

Now, the C-F Positioner moves the weldment through the routine positions under a push button control saving 24 hours crane time, 24 hours crane operator's time, and the same of both a sling man and the welder's time per weldment . . . in other words saving three man-days and one crane-day on each header produced.

C-F Positioners come in 6 sizes — capacities to 30,000 lb. All are pedestal mounted, rotate 360° and tilt to 135° beyond horizontal.

Write for Bulletin WP-22





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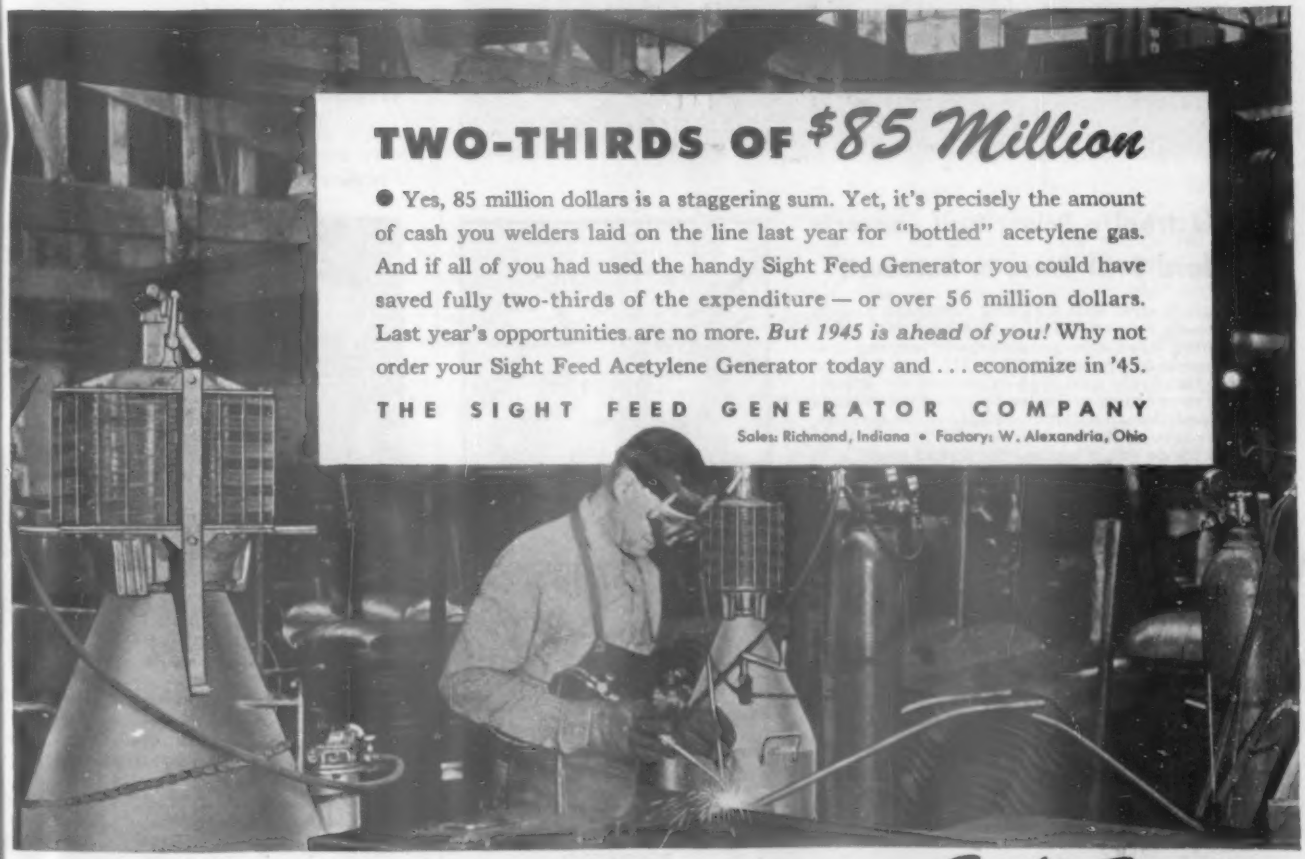

TWO-THIRDS OF *$85 Million*

● Yes, 85 million dollars is a staggering sum. Yet, it's precisely the amount of cash you welders laid on the line last year for "bottled" acetylene gas. And if all of you had used the handy Sight Feed Generator you could have saved fully two-thirds of the expenditure — or over 56 million dollars. Last year's opportunities are no more. *But 1945 is ahead of you!* Why not order your Sight Feed Acetylene Generator today and . . . economize in '45.

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"ECONOMIZE IN '45 . . . WITH *Sight Feed*"

News of the Industry

Westinghouse Prepares New Electronic Control Films

A new seven-part training course that includes a set of 35 mm sound-slide films has been prepared by the Westinghouse Electric & Mfg. Co. to set forth in a clear, understandable manner the fundamentals of electronic control for resistance welding. The material, although produced primarily for Westinghouse employees, is being made available to outsiders at reproduction costs in order to meet the many requests from engineering groups and others interested in resistance-welding control.

Subjects covered by the films are:

Part One: Basic definitions of welding technology—forge, gas, thermit, arc and resistance welding.

Part Two: Types of resistance-welding—spot, projection, seam, butt and flash. The duty cycle.

Part Three: The ignitron and the thyratron; fundamentals of electronic tubes.

Part Four: How the flow of resistance-welding current is started and stopped.

Part Five: How the amount of resistance-welding current is controlled through phase-shift heat control.

Part Six: Electronic timing controls. Basic principles. Synchronous-precision weld timer; non-synchronous timer; sequence-weld timer.

Part Seven: Energy-storage control—capacitator-discharge and magnetic types.

It is recommended that four lessons be given for this course, with two-hour classes being held one night each week. In addition to the slide films and records, the material includes seven lessons in handy pocket size and a quiz book to be distributed to each member of the class as well as an instructor's manual giving suggested classroom procedure. Informative booklets on resistance welding are also provided to supplement the course material.

For a class of 20 a complete training course costs $50. Further information can be obtained from C. R. Riker, supervisor of extension training, Westinghouse Electric & Mfg. Co., 306 Fourth Ave., Room 1712, Pittsburgh.

» «

Star Pupil Receives Welding Wire Degree

A "diploma" of be-ribboned welding wire was bestowed upon star pupil Audra Harris upon her graduation from the welding training school conducted at the Graham-Paige Motors Corp., Warren, O. This pretty 29-year-old mother set a school record by passing her Navy welding tests in 152 hours. The average period required is 175 hours.

Graham-Paige officials Raymond J. Fitness and Marvin J. Alef present a welding "degree" of be-ribboned electrodes to Audra Harris, who passed her Navy tests in 152 hours.

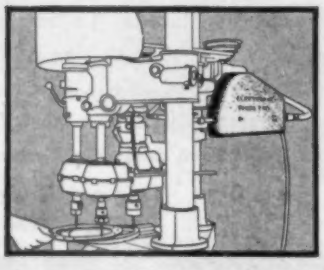
New Electroaire Power Unit Converts Standard Drill Press to Automatic

This exact control over feed and retraction speeds permits ready conversion of a standard drill press with tapping head into an automatic tapping machine, capable of producing Class III threads, even with comparatively unskilled operators. By adjusting speed to conform to the lead pitch of the threads being tapped, the tap will cut without forcing threads, and on the reverse the tap will actually "float" out of the part with no strain against the thread angle.

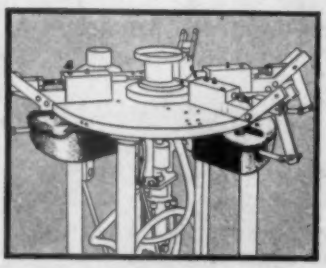
Air-powered jigs and fixtures can be opened, closed, and indexed by the Electroaire Power Feed. The unit can be set for a pre-determined number of cycles so that multiple holes can be drilled in the same piece without ejection, by means of an indexing fixture controlled and synchronized by the Electroaire Unit. One operator can run as many as two or three drill presses, turning out top-quality work with few rejects and with a minimum of tool breakage, thus effecting a great savings in time.

Present stockpiles of finest quality materials used in the manufacture of Wrigley's Spearmint chewing gum are now exhausted—necessitating discontinuance of production. When a supply of proven materials—known to be up to the finest standards of quality—is again available, Wrigley's will resume production—And Wrigley's Spearmint will be back to again help you on your job. In the meantime they are manufacturing a war brand. Wholesome but not excellent enough for the Wrigley brand name.

You can get complete information from Electroline Manufacturing Company, 1975 East 61st Street, Cleveland 3, Ohio



Set up to punch 3 holes simultaneously



Shows holes being drilled automatically

Z-55

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You can get more and better brazing, silver soldering and welding from Krembs FLUXINE Fluxes. You will be surprised how far they go. Try them just once. You will see the difference immediately.

Ask your Jobber. If he handles our FLUXINE Flux, he has your best interests at heart. He knows the FLUXINE line produces the best results with the greatest economy.

Write for chart which shows the FLUXINE Flux to use for your metal-joining problem.

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"Standard"
WELDING POSITIONER
FOR WELDING SPEEDS
FROM 0 to 2.4 R. P. M.

NEW • EFFICIENT • ECONOMICAL

Designed to rotate work up to 700 lbs. in either direction by easy hand wheel control. Linear speeds at all radii are easily set and indicated on chart above hand control wheel. For sequence or step welding, table may be positively started and stopped.

The "Standard" Variable Speed Transmission and hydraulic cylinder provide stepless speed control with a single ½ HP, 110 or 220 volt electric motor. There are no belts or clutches. The rotation of the table is started, stopped and reversed by foot pedal and hydraulically power tilted by manual lever control. A powered elevating screw provides adjustment of floor to table height between 30" and 36"

Write for latest information.

Standard
MACHINERY COMPANY

1473 ELMWOOD AVE., PROVIDENCE 7, R. I.

Pipe Oil to the Front in Welded Invasion Tubing

No longer is the old adage true about an army traveling on its stomach. Today it travels by means of the steel arteries which convey the necessary fluids of mechanized warfare. One petroleum pipe line, for example, carries enough fuel to free 250 trucks for other purposes. And, unlike a truck convoy, the pipe line makes such a poor bombing target that a 100 lb bomb must hit within a few feet of it to be effective.

The two Alliance, O., plants of the Babcock & Wilcox Co., which recently started production on their three thousandth mile of welded invasion tubing, have produced a substantial portion of the country's total output. A single welding unit in one of these plants produces between ten and twelve miles a day of the low-carbon steel tubes used for invasion pipe lines; its capacity production is between 20 and 25 miles a day.

The pipe is made in 20 ft lengths of 4 in. OD and 14 gauge wall thickness. One length weighs only 67 lb and can be handled by one man, allowing quick action in the field. Three squads of men can lay between 70 to 80 miles of line a day.

The lengths are not welded in the field but are joined together by means of a coupling device and a rubber gasket. The grooved ends of two joints of the tubes are connected and gasketed; then the bolts in the coupling are tightened. This operation is repeated on 264 lengths to complete a mile of pipe line.

» «

Tells How Wartime Pressure Improves Steel-Makers' Art

A few of the many substantial improvements in steel making which were learned under wartime pressure were described last month before the members of the Brooklyn Institute of Arts and Sciences by Dr. J. B. Austin, assistant director of United States Steel Corporation's research laboratory at Kearny, N. J.

Among the new metallurgical advances, Dr. Austin cited four which can when war ends be transferred immediately to the arts of peace. These are:

(1) The use of welding as a means of fabrication on many grades of steels not considered weldable (or weldable only with difficulties) in prewar times.

(2) The employment of a minute percentage of boron to enhance the hardenability of steel.

(3) New knowledge, experience and steel compositions for using steel at elevated temperatures, as in oil refineries, chemical processes, steam power plants and in superchargers for the development of a new turbine prime mover.

(4) The continued use of at least some of the NE low-alloy steels. These new steels, Dr. Austin explained, offer multipurpose advantages which are easily demonstrable over the unnecessarily large number of "custom made" steels provided before the war.

"Experience gained in war will also lead to improved methods of manufacture of products made from steel," the research technologist predicted. "It seems certain, for instance, that many parts hitherto machined out of solid stock will be formed by pressing sheet and strip or by welding smaller components."

» «

Pullman Inc. Buys M. W. Kellogg Co.

Pullman Incorporated has acquired the entire outstanding stock of The M. W. Kellogg Co., Jersey City, N. J., for many years a leading firm in the field of petroleum and chemical engineering. President M. W. Kellogg has been elected to the directorate of Pullman Incorporated.

The Kellogg company is being operated as a separately incorporated member of the Pullman group. With its present staff of officers and employees, it continues as a specialized research, manufacturing and engineering construction organization along the lines it has followed for over a quarter of a century.

In recent years the activities of the Kellogg company have been largely in connection with the design, fabrication and erection of plants and equipment for petroleum processing. In this connection it has been active in research on metal products. One product of the Kellogg research laboratories is a stainless-steel-clad carbon steel to resist corrosion and heat; this product is now being produced under license by steel makers and is being widely used in processing equipment where resistance to destructive corrosion and heat are important.

TOUGH LAMPS
For Rough Service
in Welding

Radiant

SPATTERPROOF
LAMPS

Radiant Spatterproof Lamps reduce production delays caused by lamp replacements to a minimum. They are made of special glass to withstand hot metal spatter. A trial order will prove the economy of Radiant Spatterproof Lamps in your own plant. Available sizes, 50, 75, 100, 150 W.

RADIANT LAMP CORPORATION
Lamps from 50 to 10,000 watts
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PROOF
Lower lamp still burns despite severe service.

P&H WELDING POSITIONERS

WELD FASTER, EASIER, AT LOWER COST!

Model WP-2—2500 lbs. Capacity

There are more big time-and-money-saving advantages in this new P&H WP-2 Welding Positioner than you would believe possible — at such surprisingly low cost.

The WP-2 is the most versatile positioner in its class — easiest to operate. Of all-welded steel construction with large table area and hydraulic power tilting — it is available with manual, handwheel or power turning. Has positive table locking device — telescopic elevation.

Write for Free Bulletin

. . . of facts and pictures giving complete story! Start now to save time, costs by positioning your work. It shows you how! Ask for Bulletin P2-1.

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The Standard of **QUALITY** **THROUGHOUT THE WORLD**

Cast Aluminum Welding Rods of Standard Analysis

Plain and alloyed Gray Iron Welding Rods and Electrodes

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...SIMPLE

...ACCURATE

A Tempil° pellet or a mark from pencil or liquid melts sharply at a given temperature at 25° to 50° intervals in the range from 125° to 1600° F. The method is simplicity itself and has a mean accuracy within 1%. Tempil° products come in three forms, pencil, pellet and liquid.

TEMPILSTIK° 125° F to 350° F in 25° steps. 400° F to 900° F in 50° steps.

For general use. Simply mark the surface of the work with the appropriate pencil. The mark liquifies sharply when the heated surface reaches the stated temperature.

TEMPIL PELLETS° 125° F to 350° F in 25° steps. 400° F to 1600° F in 50° steps.

Place on area to be heated. Pellet liquifies sharply when predetermined temperature is reached. Recommended where conditions of heating operation prevent close observation.

TEMPILAQ° 125° F to 350° F in 25° steps. 400° F to 1600° F in 50° steps.

Daubed on working surfaces, dries quickly, liquifies sharply at stated temperatures. For areas not conveniently accessible and for glazed and polished surfaces.

Write Gordon today for Tempil° Preheating Chart, Tempil° scale for weld bend testing, complete information on Tempil° products.

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7016 EUCLID AVENUE • CLEVELAND 3, OHIO

Linde Slide Films Teach Oxy-acetylene Processes

An industrial teaching aid in the form of a series of how-to-do-it slide films and accompanying instruction literature on oxy-acetylene welding and cutting operations has been completed by The Linde Air Products Co. Covering the basic techniques of welding and cutting, the lessons are carefully planned to be as adaptable to streamlined war production as to the tempo of peacetime and to fit the needs of beginner and "old timer" alike. They are arranged in three series:

(1) A cutting series consisting of eight lessons on the connecting, testing and lighting of the oxy-acetylene torch and instructions for making straight-line cuts.

(2) A welding series in ten lessons showing how to connect, test and light the oxy-acetylene welding torch and giving basic welding instructions for light plate.

(3) A safety series of two lessons. One lesson is given on the care and handling of equipment; the second lesson is on fire precautions.

Each film series comes with three instructor's handbooks, giving suggested teaching procedures, and 25 student handbooks. The latter contain a written record of the step-by-step procedures shown in the films. Both the slide films and accompanying literature may be obtained at a nominal price through any office of The Linde Air Products Co.

» «

Pullman-Standard to Build Welded Army Hospital Cars

As its shipbuilding program for the Navy neared an end, the Pullman-Standard Car Mfg. Co. began the construction of 50 hospital cars for the Army in its plant at 111th St. and Cottage Grove Ave., Chicago. These new cars will be lightweight, self-contained units of welded high-tensile, low-alloy steel. Their overall length will be 84½ ft—10 ft longer than the earlier type of hospital cars.

A ward fitted with five three-tier longitudinal beds on each side of the aisle takes up the center of each car. Adjoining the ward at one end of the car are quarters for the medical officer and attending nurse, shower and storage lockers. In the other direction there are, successively, a section with a sterilizer room on one side and a toilet and washroom on the other, a compartment with two three-tier beds for seriously ill patients, a receiving room and pharmacy. Finally there is a completely equipped kitchen, a facility which the earlier hospital cars have lacked. To add further to patients' comfort, the new cars will be air conditioned.

The Pullman-Standard plant was freed for the construction of the hospital cars by the virtual completion of prefabrication and subassembly work on patrol craft and landing ships. Schedules called for the last patrol craft escort to be launched by the end of January and for the final landing ship to be launched in March.

» «

License Manufacture of "Aldecor" Steel

Carnegie-Illinois and other subsidiaries of United States Steel, Republic Steel Corp. and Lukens Steel Co. have been licensed by the Alloys Development Co. for the manufacture of "Aldecor," a new alloy steel of the "Cor-Ten" type. This alloy has been successfully applied and tested in box car ends and miscellaneous parts for railroad freight cars, mine cars and other similar structures. It is understood to have good welding properties as well as substantial resistance to atmospheric corrosion.

» «

Opens Chicago Office

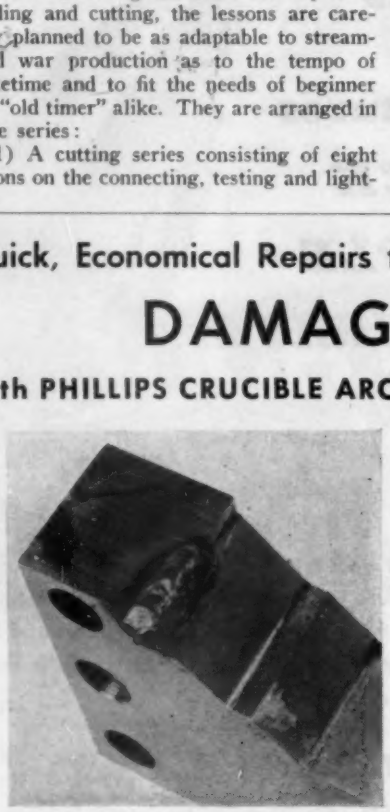
An office and warehouse at 565 West Washington Blvd., Chicago 6, has been opened by the Superior Valve & Fittings Co., Pittsburgh manufacturer of high-pressure gas cylinder valves, manifold valves and related products. This warehouse will supply customers in Illinois, Wisconsin, Minnesota, Iowa, Missouri, Kansas, Nebraska, Colorado, Indiana, the western tip of Kentucky and the western half of Michigan.

Irving A. Wilson, Superior's midwestern representative, will continue to manage the Chicago operations. He will be assisted by Thomas E. Cunningham, who has been transferred from the factory to have charge of the new office and warehouse.

Quick, Economical Repairs to

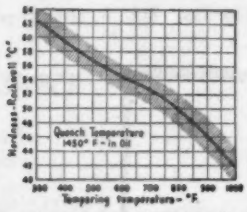
DAMAGED DIES

with PHILLIPS CRUCIBLE ARC NO. 72 SPECIAL ELECTRODE



Application Procedure for No. 72 Special

Use electrode positive. Prepare clean, bright surface for each application. When multiple layers are deposited, clean carefully between layers. Current settings will be approximately the same as for mild steel electrodes of the same diameter. To obtain high hardness as welded, avoid heating the adjacent base metal above the tempering temperature.



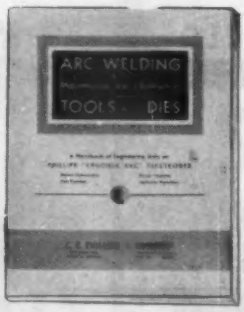
Tempering Curve, No. 72 Special

THIS repair of an oil hardening steel forming die is typical of repairs that are being made every day, saving hours and dollars with PHILLIPS CRUCIBLE ARC TOOL and Die Steel Electrodes. No. 72 Special was selected for this job because it is particularly effective in cases where it is not practical to heat treat the piece after welding.

Deposits of No. 72 Special are very hard and tough in the as-welded condition, when properly applied. Hardness as deposited is approximately Rockwell C61 when cooled fairly rapidly, and the metal has high non-shrinkage characteristics. Hardness values obtainable by heat treatment are indicated by the accompanying curve.

This electrode will get your production manager out of many tough spots at a surprisingly low cost. Complete information on its use, with much valuable data on other aspects of metal arc welding on tool and die steels will be found in our handbook. Copy on request.

No. 72 Special as Deposited (250X)



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Send for this free manual on arc welding Tool and Die Steels

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Save Time—Labor—Expense

Speed up production — end needless delays! It takes only *3 seconds* to HOOK-UP — LENGTHEN — REPLACE or SHORTEN Cables with PALMGREN Cable Connectors. Construction assures positive contacts, highest conductivity with secure locking of connectors. No parts exposed — insurance against shorting and fire hazards. Connectors will handle 1, 1/0, 2/0, 3/0 and 4/0 cables.

PALMGREN Engineers will gladly design new types of connectors to meet your industrial need. Having pioneered this field, we developed many types for use in Welding —Mining—Supply Lines—Ships—Railways, etc., wherever conductor cables are used. *Write us today!*

Just a Twist of the Wrist

Simply grasp the two halves and turn in opposite directions. A ½ turn locks or unlocks. No tools required—no bolts, nuts, washers or gadgets to loosen.

TYPE P A Female Connector for Angle Mounting · TYPE P P Female Connector for Panel Mounting · TYPE P S Female Half Connector · TYPE M S Male Half Connector · TYPE M P S Complete Cable Connectors

Write for Circular A-8 describing complete line, also price list

CHICAGO TOOL AND ENGINEERING CO.

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The NEW, IMPROVED Variable-Core type

GREYHOUND

A. C. Arc Welders Provide LOWER OPERATING COSTS for HEAVY DUTY PRODUCTION

Detailed information and prices sent on request

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GREYHOUND A. C. ARC WELDER CORP.

Manufacturers

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use this **APPROVED PROTECTION** against harmful metal fumes!

The **WELDER'S MODEL**

M·S·A Comfo

METAL FUME RESPIRATOR

(Approved by U. S. Bureau of Mines)

- On-the-job protection against harmful fumes encountered in welding metals coated with or containing zinc (galvanized) or lead (paint) or other toxic metals, is provided by the special Welder's Model M.S.A. Comfo Metal Fume Respirator.

Designed for use under all types of welding helmets, with a guarded, double-seat exhalation valve that cannot be accidentally shut off, the Welder's Model offers all the regular Comfo features of outstanding durability and wearing ease, plus new-type filters for approved Metal Fume protection. Write for detailed Bulletin CR-8.

Specially processed filters of maximum efficiency have double the usual area, offer minimum breathing resistance, are easily changed when necessary.

MINE SAFETY APPLIANCES CO.

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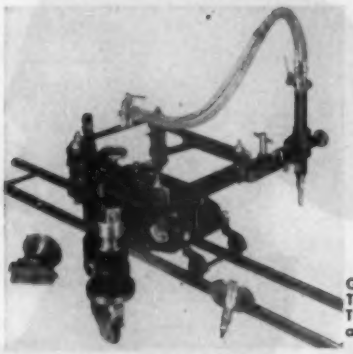
NOW COMPLETE PORTABLE SHAPE CUTTING FACILITIES



To the popular uses of portable cutting machines there has now been added the luxurious control-ease and accurate shape cutting reproduction of high priced shape cutting machines. Every Steel Fabricating Shop needs the new popular priced GASO V-10 with automatic shape cutting attachment. Tracing irregular shapes and circle cutting are made easy and accurate on the new GASO V-10 with automatic shape cutting attachment. Optional attachment allows spindle head operation and template head operation, the latter enabling large quantities of duplicate parts to be automatically and accurately flame cut.

GASO V-10 CUTTING MACHINE WITH TRACING HEAD MOUNTED FOR OPERATION. The template is shown on the left and the spindle head at the right.

GASO V-10

TWO MACHINES IN ONE

All portable, the new, popular priced GASO V-10 with automatic shape cutting attachment performs the functions of two machines in one: Automatic straight line cutter and automatic shape cutter. The GASO V-10 with automatic shape cutting attachment is: motor driven; fully automatic on all shapes; adjustable 3"—60" per minute; designed for instant start and stop; and equipped with unitary shut-off valve. The GASO V-10 is equipped with 5 foot track—cutting table optional.

Shape Cutting Attachment.

Some Distributor Territories Still Available.
Write today for new bulletin giving full information.

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Off the Floor Deliveries! ON TRINDL SUPER INDUSTRIAL ARC WELDER

DESIGNED FOR HIGH SPEED PRODUCTION ARC WELDING

TRINDL SUPER INDUSTRIAL ARC WELDERS, the result of many years of careful engineering and "job tested" research, are rolling up impressive production records. Acclaimed for superior performance, ruggedness, dependability, and economical operation.

For better, faster welding, easy-to-operate TRINDL SUPER INDUSTRIAL ARC WELDERS will help step up your production schedules 20% to 40%. Manufactured in a range of distinctive sizes to accommodate every type of shop and production welding job.

Trindl Welders, Electrodes, supplies and accessories, available for immediate delivery, will save you both time and money. Write, wire or phone for full details.

TRINDL PRODUCTS, LTD. 11 EAST 23rd STREET AR CHICAGO 16, ILL.

Whiting Corp. Adopts Employee Pension Plan

Under their company's recently adopted pension plan, 457 employees of the Whiting Corp., Harvey, Ill., have received passbooks in which were entered the amounts credited to each individual for the first two years covered by the plan.

The purpose of the plan is to provide for retirement at age 65 (sooner under certain conditions) and to render aid in case of disability or illness. An employee becomes eligible for participation in the pension trust after he has completed five years of employment. Funds for the trust are provided by the company; employees do not contribute at all.

The extent of an employee's participation is determined in part by length of service, in part by his annual earnings.

» «

Marinship Awarded New Tanker Contract

Award of a new shipbuilding contract to Marinship Corp., Sausalito, Calif., will result in continued production of tankers at present levels of employment until the fourth quarter of 1945, it was announced recently by William E. Waste, vice-president and general manager.

The new contract calls for the construction and delivery of four additional Navy oilers similar to the six now being completed at Marinship outfitting docks. Each is to be driven by a 10,000 hp turbo-electric motor.

The oilers are 523 ft long with a beam of 68 ft and a loaded draft of 30 ft. Each has a deadweight tonnage of 16,500. Though the oiler hull in general resembles the hulls of merchant tankers, there are many important changes and additions to make the Navy ship a combination transport-fighter.

» «

Service Emblems for Employees Given at Philadelphia Quartz

To recognize the long years of continuous service of its men and women workers, the Philadelphia Quartz Co., Philadelphia manufacturer of silicate of soda, has established a new employees' service-emblem plan.

Employees associated with the company for ten years or over will receive silver or gold pins or buttons designating their specific periods of service. The emblem is patterned from the company initials, "P Q," the "Q" forming the outside border. For 25, 30, 35 and 40 years of service, jewels are added.

Fifty-five employees have been with the company for over 25 years. Records of 15 years or longer have been achieved by 36% of the plant employees and 34% of the office employees.

» «

Lincoln Moves Peoria Office

The Peoria, Ill., office of The Lincoln Electric Co. is now located in larger quarters in the Electrical Building, 214 Second Street. The office will continue to be in charge of L. W. O'Day, who has been Lincoln manager at Peoria for four years.

HERCO VARIABLE CORE ARC WELDERS

MODELS FROM 150 TO 1500 AMPERES WITH OR WITHOUT POWER FACTOR CORRECTION

for:

24 hour per day operation.
Exact heat control.
Increased production.
Lower power costs.
X-ray test welding.
Ease of operation.

Inquire about MAGNETIC CLAMPS for quick positioning and alignment.

HERCULES ELECTRIC & MFG. CO. INC.

MANUFACTURERS OF THE PRECISION WELDER WITH THE STREAMLINED ARC

2500 ATLANTIC AVENUE · BROOKLYN, N. Y.

Best for AC General Purpose

DUCTONE AC

(E6011 AND E6013)

WELDING RODS

Ductone AC electrodes are available again. This is the famous welding rod that was designed and manufactured especially for AC welding. DUCTONE AC rods assure low cost of operation. They have a high deposition rate and are noted for their ease in striking and maintaining an arc. Small sizes are good for thin sheet metal. Excellent for vertical and overhead welding on DC positive polarity. Extruded in all sizes from 1/16" to 1/4".

Territories Available for Distributors

Reach for DUCTONE *AC Welding Rods*

Chicago Steel and Wire Co.
103rd St. and Torrence Ave.
Chicago 17, Illinois

START THE ARC *Automatically*

NO PECKING or SCRATCHING with the

MISSING LINK AUTOMATIC ARC HY CYCLE UNIT $59.50 COMPLETE

★ It's easy to start the arc with this new advancement in electric welding . . . the "MISSING LINK." Arc starts automatically without the annoying, tiresome, obsolete method of "pecking" and "scratching" the work to get going. Attach "Missing Link" to any arc welder, AC or DC. Use any type of welding rod and get faster, better welding with greatly reduced operator fatigue. What's more, beginners can become experts almost overnite with the aid of this unit. Makes work far easier for experienced welders.

Multiply your man-hours and get many other cost-reducing advantages, by equipping with the "Missing Link." Act now! Get complete details on this low-cost, time-saving unit.

See Your Jobber or Write Direct

Mid-States EQUIPMENT CO.

2431 SOUTH MICHIGAN AVENUE, CHICAGO 16, ILLINOIS

Helpful Literature Just Published

The following reviews are of recent publications of interest to those in the welding industry. Unless otherwise stated, they may be obtained without cost by writing to the manufacturers listed.

Fundamentals of Electronics

Industrial electronics is today playing a mighty role in war production, where this industrial tool has been responsible since Pearl Harbor for saving millions of man and machine hours as well as millions of pounds of critical materials.

Those who would like to have working knowledge of both the basic principles involved and their commercial applications may find what they want in "Fundamentals of Industrial Electronics," GEA-4309. This 44-page, letterhead-size booklet reprints a series of eight articles by G. M. Chute, application engineer of the General Electric Co., Detroit, which appeared in *Steel* from April 3 to May 22, 1944. Resistance-welding controls are discussed in full detail, while photoelectric circuits and their applications and the principles of electronic induction are covered in later articles. **General Electric Co.**, Schenectady 5.

» «

Cutting-Tip Bulletin

A 12-page, four-color, letterhead-size bulletin, No. ADG-2008, describes the Airco "45" and "45M" high-speed flame-cutting tips. Cross-sectional drawings and photographs are reproduced to show how the orifices in these tips were specially designed to cut a narrower path or kerf than the standard cutting tips. This is said to provide faster cutting speeds without increased gas consumption per inch of cutting. Other illustrations, including charts and tables, give specification data for both the "45" and the newer "45M" tips. The latter tip is stated to be particularly adaptable for cutting rusty and scaly plate, bevel cutting and to the use of hydrogen as a fuel gas. **Air Reduction Sales Co.**, 60 East 42nd St., New York City 17.

» «

V-Belt Drive Data

A new Allis-Chalmers catalog, B6051E, reduces to handy charts, tables and drawings the information required to make correct selections of V-belt drives. The 12-page, letterhead-size bulletin includes a quick picture-story of the company's new "Magic-Grip" sheave. Another section gives list prices, stock sizes, dimensions, construction details, etc., for all "Texrope" drives. **Allis-Chalmers Mfg. Co.**, Milwaukee 1, Wisc.

» «

Remote Control Booklet

A 38-page, letterhead-size book, "Stow Flexible Shaft Remote Valve Operating Gear," has been published to serve as a guide in the selection, installation and use of flexible shafting for remote control operation of valves and other equipment actuated by a rotating shaft. The flexible shaft, it is stated, has many advantages over rigid rod gearing for the operation of valves as it eliminates the use of mitre wheels, universal joints, etc. The pages of this booklet are devoted primarily to marine applications; however, the flexible shaft is equally adaptable to remote control in other fields. **Stow Mfg. Co.**, Binghamton, N. Y.

» «

Jobs for Air Power

"A little air power will do many a big job," Ingersoll-Rand asserts on the cover of a newly published 24-page, letterhead-size two-color booklet, Form 1011. This book, states the publisher, constitutes a virtual clearing house to enable production men to benefit from one another's ideas. Nearly 70 pictures show how to put familiar air-operated equipment to work in new ways. Several ingenious "Rube Goldbergs" that can easily be made in the shop are illustrated. **Ingersoll-Rand Co.**, 11 Broadway, New York City 4.

Switch to Brazing with "BRIDGEPORT" BRONZE

Repairing a 20-Ton Capacity Chain Bench

A new lug on this 40,000-lb. casting was built up around an electrode by brazing with Bridgeport Bronze Rod.

Bridgeport Bronze Welding Rods are performing valuable service by putting broken machinery and equipment back to work as quickly as possible.

Take, for example, this 40,000-pound capacity chain bench gear reduction unit. The main support lug fractured so badly that it looked as if it might be necessary to replace the part. That would have required several weeks. However, through the use of Bridgeport Bronze Welding Rod, an entirely new lug was formed by building up Bridgeport Bronze around a carbon rod of the desired size. The unit has been in operation for seven months without any sign of failure, despite considerable strain at that particular point.

For easy flow, good adhering quality, and strong, tough, dependable welds, specify "Bridgeport."

Send for this free practical, up-to-the-minute booklet for welders. It contains complete data on selection and use of bronze welding rod.

"Bridgeport" BRIDGEPORT BRASS COMPANY
BRIDGEPORT 2, CONN. • Established 1865

Bronze Welding Rod A PORDUCT OF BRIDGEPORT BRASS

FOR YOUR TOUGH *LOW* TEMPERATURE BRAZING JOBS

Specify A-P-W

SILVER BRAZING ALLOYS

Furnished in any form, strip, coiled wire, wire rings, flat washers and special shapes to your specifications.

There's an A.P.W. Silver Brazing Alloy for every industrial purpose. Our leaders include:

- **Various alloys covered by Federal Government, Army, Navy, Air Corps and A.S.T.M. specifications.**
- **A.P.W. G-355 "Ready Flow". A patented low-melting point alloy (1165°F). Contains no cadmium, develops no pin holes. Bonds ferrous and non-ferrous metals.**

A.P.W. FLUX PASTES — *Excellent cleaning action—Safe and convenient in use.*

Inquiries invited. Booklet (W-E) on request.

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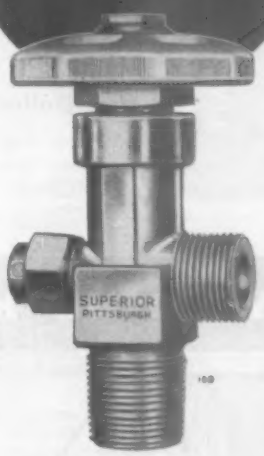
N. J. R. R. AVE. AT OLIVER ST. NEWARK 5, N. J.

PRECIOUS METALS SINCE 1875

Superior HIGH-PRESSURE GAS CYLINDER VALVES



Write for Catalog

Packed and Diaphragm Packless Valves... for use with Hydrogen, Ethylene, Nitrous Oxide, Carbon Dioxide, Medical and Commercial Oxygen, Oil-pumped and Water-pumped Nitrogen.

THE INDUSTRY STANDARD—not a revolutionary design—improved to prolong its years of service—reduce maintenance cost—increase its margin of safety.

SUPERIOR hot-forged valve bodies are *generously* heavy—especially around the packing nut and stem—to provide the *extra* strength which many years of experience indicate is required to enable the valves to successfully withstand the abuse to which they are often subjected. The heavy knurled octagon handwheel provides excellent gripping surface—replacement parts are interchangeable with other valves of similar size and design.

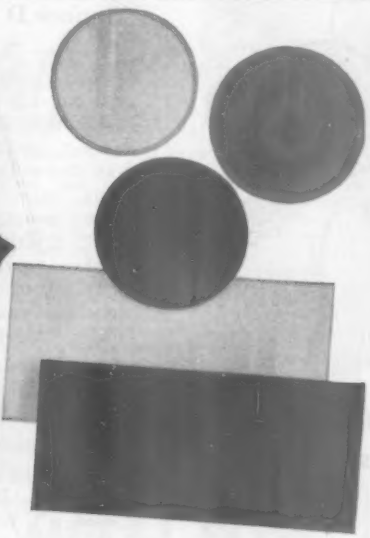
Superior safety device specifications are on file with Bureau of Explosives, for convenience in obtaining prompt approval for use in interstate commerce.

SUPERIOR VALVE & FITTINGS COMPANY

PITTSBURGH 26, PENNSYLVANIA

OFFICES IN PRINCIPAL CITIES · WEST COAST STOCK, LOS ANGELES (15) JOBBERS EVERYWHERE

Something "Extra" IN LENSES AND PLATES



● **"Eye-Gard" Lenses and Plates cost you no more than ordinary lenses and plates, yet you get something "extra" in the way of quality and performance with every one you buy. Made and finished by experts, who are specialists in the art of making welding glass, they provide the utmost in safety for the eyes regardless of hazard. To be certain of securing the right lense or plate for the purpose, write for the new Eye-Gard Catalog which contains a handy lense selector chart. It's yours without obligation!**

"EYE-GARDS" PROTECT THE WORKER... PROTECT THE JOB!

AMERICAN INDUSTRIAL SAFETY EQUIPMENT CO.

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DIVISION OF THE BURDETT OXYGEN COMPANY · CLEVELAND, OHIO

Har-Worth ELECTRODE HOLDER

FULLY VENTILATED

COMPLETELY INSULATED

LESS FATIGUE. Light in weight, 17 oz., well balanced, streamlined, easy to handle. Makes work less tiresome.

NO ROD WASTE. Takes rods from smallest to 1/4-in. Vice grip holds in all positions. No need to bend rod and destroy flux. Release lever provides quick and easy rod change-over.

SAFER WELDING OPERATION. High-test, heat resisting, eliminates accidental flashes, spoilage of work.

All parts replaceable. 300 amps., 9 1/4-in. in length reasonably priced.

DEALERS—Several attractive territorys still open for distributors. Write factory for details.

HARWORTH MANUFACTURING CO.

9731 S. W. CAPITOL HIGHWAY · PORTLAND 1, OREGON

Tool-Brazing Bulletin

A four-page, letterhead-size bulletin, No. 11-A, discusses the brazing of carbide tool tips with silver-brazing alloy. Detailed instructions are given for a seven-step torch-brazing procedure, while furnace and induction brazing are briefly summarized. The fourth page of the bulletin is devoted to the torch brazing of high-speed-steel tips to carbon-steel tool shanks. **Handy & Harman,** 82 Fulton St., New York City 7.

» «

Welding Equipment Catalog

An attractive new spirally bound catalog of gas and electric welding and cutting supplies has been issued by **Chicago Welding Sales Co.,** 3349 Ogden Ave., Chicago 23. Among the items listed in its 52 pages are: a-c arc welders, acetylene generators, fluxes, welding rod, electrodes, spatter preventatives, welding cable, cable connectors, flame-cutting machines, goggles, hand shields, helmets, lenses, lighters, chipping hammers, symbol hammers, wire brushes and many other welding products.

» «

Flux Bulletin

A four-page, letterhead-size bulletin describes Superior No. 6 flux for silver soldering and gives detailed instructions for its use. This flux, it is stated, can be used with any low-melting-point brazing alloys or silver solders for the joining of both ferrous and non-ferrous metals. **Superior Flux Co.,** 913 Public Square Bldg., Cleveland.

» «

High-Voltage D-C Supply

A four-page, letterhead-size bulletin, GEA-4317, is released by **General Electric Co.,** Schenectady, N. Y., to describe and illustrate metal-enclosed equipment to produce a source of high-voltage d-c power for such applications as induction heating, precipitation, equipment testing, etc. Equipments of this type use electronic tubes (kenotrons) for rectification and can be designed for ratings up to approximately 50,000 volts d-c.

» «

Carbon Products Catalog

"National and Karbate Carbon and Graphite Products" is the title of National Carbon's newly issued Catalog Section M-8000-A. This 20-page, letterhead-size bulletin describes and illustrates a wide variety of carbon, graphite and "Karbate" products manufactured for use in the chemical, metallurgical, mechanical, electrical and other industries. Carbon electrodes for welding and brazing are among the products covered. **National Carbon Co., Inc.,** 30 East Forty-Second St., New York City 17.

» «

"Square D Digest"

"Square D Digest Number 129" is an abridged catalog offered to replace Digest No. 128 dated April, 1942. The new publication, a 76-page, letterhead-size catalog, contains many pictures and listings of products not covered in the previous issue. Among the products it covers are safety switches, service equipment, multibreakers and other circuit breakers, panelboards, bus and feeder ducts, motor control and pressure switches. Switch and Panel Div., **Square D Co.,** 6060 Rivard St., Detroit 11.

» «

Technical Book Catalog

A new catalog of technical books has just been issued by **The Chemical Publishing Co., Inc.,** 26 Court St., Brooklyn 2, and will be sent free to all interested in keeping up with the latest technical and scientific progress. This catalog includes the latest books on engineering, mathematics, metallurgy, general science, technology, physics, chemistry, technical dictionaries, etc. It gives the date of publication of each book, its price and a detailed description of the contents.

» «

Crane Catalog

Catalog No. 58 of the **Silent Hoist Winch & Crane Co.,** 841-877 63rd St., Brooklyn 20, is a 24-page, letterhead-size booklet describing the "Krane Kar" mobile swing boom crane.

DOCKSON WELDING HELMETS

A complete line of Welding and Safety equipment

Equipped with No. 4 headgear—quickly and easily adjusted.

Molded, one piece shell.

Deep shell affords extra protection.

Leak proof lense holder.

Adjustable pivot assembly.

Light, sturdy, shock-proof construction.

Stocked by a Dockson dealer near you.

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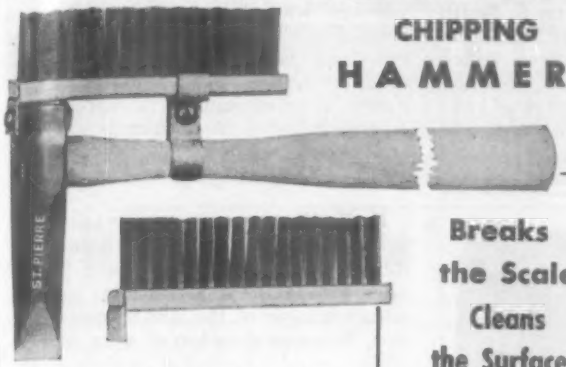
3839 Wabash • Detroit 8, Mich.

ABUSE MEANS NOTHING TO ST. PIERRE

CHIPPING HAMMERS



Here's a man-sized brush in the right position for easy use after chipping scale from welded surface. Hammer-Chisel made of highest quality tool steel. Entire tool is well-balanced. For economy, for durability use ST. PIERRE Hammers.

Breaks the Scale Cleans the Surface in One Operation

Order Today From Your Jobber or Direct

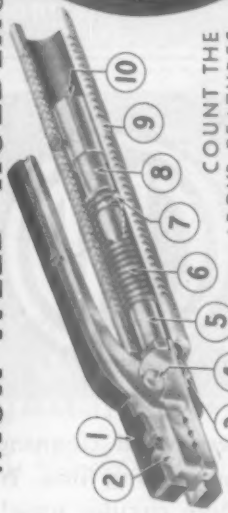
ST. PIERRE Chain Corporation

WORCESTER DROP FORGINGS MASSACHUSETTS

MOR-WELD HOLDERS

Last FROM 20 TO 30 TIMES LONGER Due to Special Plastic Compound Used in Jaws

Scientifically Simple!



COUNT THE ABOVE FEATURES

1. "Everlast" plastic jaw cover. 2. Heavy duty cast bronze, cadmium plated jaws extend into both insulated handles. 3. Spring tension applied direct to upper jaw. 4. Over-strength jaw bearing. 5. Heavy male contact rod. 6. Steel coil, rod grip tension spring. 7. Adjustable tension thread. 8. Rear female contact rod. 9. Insulating red fibre handle. 10. Electric cable connector block.

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DESIGNERS AND PRODUCERS OF SPECIAL EQUIPMENT

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HOBART *Arc Welding School* trains quickly, thoroughly

Classes for MEN *and* WOMEN

Hobart's school is not a war-time offspring. Established long before the war to give experienced operators to the fast growing business of arc welding. ***Instructors Are Expert Welders...*** and they are expert teachers, too. They've all had years of experience showing others the correct procedures of every type of welding.

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Many plants send men and women to increase their welding operations.

Write Today FOR LITERATURE

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PRECISION BUILT "LAB" SIZE EXTRUSION PRESS

This compact combination 16-ton hydraulic extrusion press and automatic wire feeder is designed for laboratory duplication of actual production conditions (capable of 20,000 PSI pressure). It is so successful in operation, so precisely built, that it can even be used in welding rod manufacture on a small scale. . . . Comes complete with die-head, controls and motor, all ready to set up, connect to power line and start producing. Hydraulic and electrical controls at operator's fingertips. Welded steel construction . . . Prompt delivery . . . Write for full details.

Moslo Makes Everything For the Welding Rod Processing Plant

MOSLO MACHINERY CO.

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METAL BOND Trade Mark — Metal Bond Mfg. Co. St. Louis U.S.A.

METAL BOND

Welding and Brazing Fluxes are Quality Products

SEND CARD FOR OUR A-4 CATALOG

All Metal Bond products are sold on—"The user must be satisfied or he returns unused portion in original package for 'Money Back'."

METAL BOND MANUFACTURING CO.

3201 Kossuth Avenue St. Louis 7, Missouri

ABOUT PEOPLE

R. E. (Rudy) Fritsch, formerly vice-president of Tube Turns, Inc., Louisville, has been elected president of this organization, and **G. O. Boomer,** executive vice-president of Tube Turns, has been elected president of The Girdler Corp., Louisville. Both of these presidencies were formerly held by the late **Walter H. Girdler.** Messrs. Fritsch and Boomer have also been elected to the board of directors of both companies.

F. H. Hirschland was elected chairman of the board of the Metal and Thermit Corp. and **Frank J. O'Brien** president at a recent meeting of the board of directors. Mr. Hirschland has been president of Metal and Thermit since 1922. The new president, Mr. O'Brien, was until recently vice-president of Continental Can Co., Inc.

» «

John B. Tinnon and **Walton S. Smith** continue as vice-presidents of Metal and Thermit; both men have also been elected to the corporation's board of directors. Mr. Tinnon will continue to serve as vice-president in charge of sales and Mr. Smith as vice-president in charge of production. **E. Beecher,** formerly first vice-president, has retired.

» «

Rae F. Bell, former first vice-president of the A. O. Smith Corp., Milwaukee, has been elected chairman of the board of directors to succeed the late L. R. **Smith. Anthony von Wening,** formerly a vice-president of the Continental Illinois National Bank and Trust Co., Chicago, was elected vice-president and controller. **W. C. Heath** continues as president, **John M. Floyd** as vice-president in charge of manufacturing, **R. Furrer** as vice-president in charge of engineering and **J. J. Stamm** as secretary and treasurer.

» «

H. F. Henriques, formerly sales manager of the north central division of Air Reduction, has been appointed general sales manager. **J. J. Lincoln,** formerly sales manager of the south central division, becomes director of sales services.

» «

C. M. Bloodgood, who has been serving as sales manager of the Pacific coast division of Airco, has been appointed assistant to the vice-president in charge of sales. **H. P. Etter,** heretofore manager of the Los Angeles district, becomes sales manager of the Pacific coast division, with headquarters in the Mills Tower Building, San Francisco.

» «

Elliott R. Vinson, former electronics technician at the U. S. Naval Air Station, Alameda, Calif., has been appointed electronic tube specialist for the Pacific coast district of Westinghouse Electric and Mfg. Co. His headquarters will be in San Francisco.

» «

F. Emery Garriott has joined Ampco Metal, Inc., Milwaukee, as "Weldrod" development manager. Mr. Garriott was formerly with the A. O. Smith Corp. in Milwaukee and later in Houston, Texas, as manager of that firm's Texas welding electrode plant.

» «

C. F. Patterson has joined the field engineering staff of the Eutectic Welding Alloys Co., and will service customers in Michigan. Mr. Patterson formerly served the Murray Corporation for 18 years.

» «

John A. Owen has also joined the staff of the Eutectic Welding Alloys Co. Mr. Owen, a veteran weldor, owned and operated a welding and machine shop for 28 years. He will serve as Eutectic field engineer for the state of North Carolina.

» «

W. S. O'Connor has been appointed district sales manager for the New York office of the United States Gauge Co., Sellersville, Pa. The office is located in the Woolworth Building, 233 Broadway, New York City.

Ask for CMD WELDERS' CHIPPING HAMMERS

A type for every weld cleaning need. Cutting edges stay sharp a long time. Write Department 4W for descriptive circular now!

TYPE CB
Triple Duty
Combines 3 tools in 1—drift, chisel, and removable wire brush.

TYPE A
Drift and Chisel
Made from high-grade tool steel. Especially popular in malleable iron and grey iron foundries for general chipping.

TYPE C
Drift and Chisel
Same as Type CB but without brush.

CHICAGO MANUFACTURING AND DISTRIBUTING COMPANY
1928 WEST 46th ST., DEPT. W., CHICAGO 9, ILLINOIS

DALLETT PNEUMATIC *Weld-flux* SCALING HAMMERS

• SAFETY CHISEL RETAINER
• BUTTON OR LEVER TYPE THROTTLE
• MADE IN SEVERAL SIZES
• SMOOTH IN OPERATION

Canadian Dist.: G. D. Peters & Co. of Canada, Ltd., 1021 New Birks Bldg., Montreal

• LIGHT IN WEIGHT

Write for Bulletin No. 500

Especially designed for roughing, peening and removing flux and surplus metal in welding operations. The welders' *first choice* of scaling Hammers. Precision Built by Dallett.

PNEUMATIC AND HAND CHISELS
"DALBO" AIR HOSE COUPLINGS
"DALLETT" PNEUMATIC SAFETY RETAINER SHANK CHISELS
"DALWELD" DETACHABLE WELDING CABLE CONNECTORS

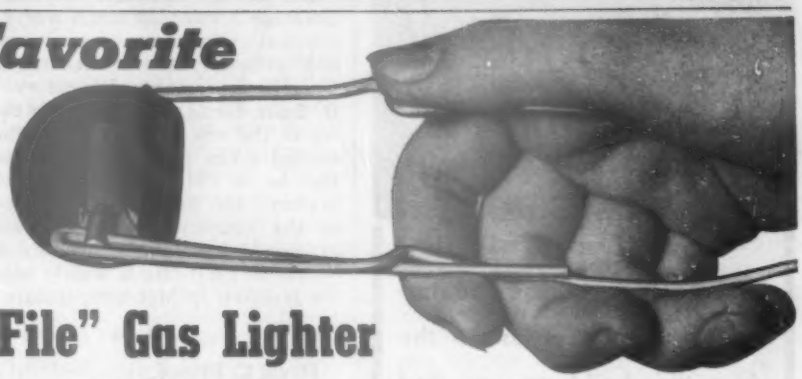
PNEUMATIC DALLETT EQUIPMENT ACCESSORIES
ESTABLISHED 1883

THE DALLETT COMPANY
MASCHER AT LIPPINCOTT STREET, PHILADELPHIA 33, PA.
Manufacturers of Pneumatic Tools and Accessories

The Welders' Favorite

Many superior design and construction features combine to make the Improved "Round File" the most efficient and economical torch lighter.

An unusually large file area (approx. one sq. inch) is provided. The file is of superior quality, hardened in our own factory. Spark metal is of large diameter and the patented cartridge holding the metal locks exactly into position, permitting instant replacement.



The Improved "Round File" Gas Lighter

SAFETY GAS LIGHTER CO. (Est. 1901) LYNN, MASSACHUSETTS

W-AL-CO RODS for Welding of ALUMINUM

ARC WELDING ELECTRODES
(Flux-Coated)

Type E-43—5% Silicon-Drawn Aluminum
Type E-2S—Pure Drawn Aluminum
*Types E-142, E-195, E-355 and E-356—Aluminum Alloy for welding CAST ALUMINUM

Send for descriptive circular.

GAS WELDING RODS
(Flux-Coated)

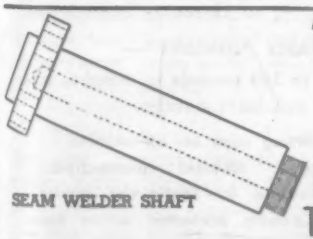
Type G-43—5% Silicon-Drawn Aluminum
Type G-2S—Pure Drawn Aluminum
*Types G-142, G-195, G-355 and G-356—Aluminum Alloy for welding CAST ALUMINUM

*Available in 1/16" size only

Assure dense, ductile, strong welds. Ease of Control; Free-Flowing Characteristics; Increased Welding Speeds.

WELDING ALLOYS MANUFACTURING CO. 744 Broad St., NEWARK 2, N. J.

"ELECTROLOY" for RESISTANCE WELDING



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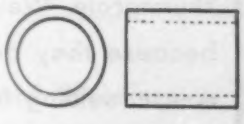
Butt
Flash
Spot
Seam
Projection

ELECTROLOY

Catalog and Prices on Request



SEAM WELDER BUSHING

THE ELECTROLOY CO. INC. 1600 SEAVIEW AVE. BRIDGEPORT, CONN.

JOHN NAGELDINGER & SON, INC.

Manufacturers: OXYGEN THERAPY APPARATUS ☆ CYLINDER VALVES ☆ CYLINDER MANIFOLDS ☆ NEEDLE VALVE CONTROLS ☆ WELDING AND CUTTING EQUIPMENT ☆ PRESSURE REGULATING VALVES & REGULATORS ☆ SAFETY VALVES ☆ COMPRESSED GAS APPARATUS FOR: OXYGEN, HYDROGEN, NITROGEN, ACETYLENE, CARBON-DIOXIDE, HELIUM, ETC.

Send for 32-Page Catalog Featuring Welding and Cutting Equipment and Supplies.

Established 1880 **409 East 91st Street** FACTORY AND OFFICE AT **New York City 28, N. Y.** TELEPHONE: **Atwater 9-6843**

AYCOCK *Says:*

ABOUT *Thermacote*
Plastic Coated
WELDING LENSES

"Our welders all use Thermacote Welding Lenses on the ships we build as we find them a great time saver, a most important factor, as we are on a straight contract job and time means money to us."

C. F. Aycock, Supt. of the Welding Dept. Higgins Industries, Inc. has had years of experience in welding. Like many others of long experience, Mr. Aycock prefers Thermacote Welding Lenses because they definitely increase welding footage.

THERMACOTE CO.

122 Arlington Street, Newark 2, N. J.
612 No. Michigan Ave. 11, Chicago, Ill.
1101 McLaughlin Blvd. Portland 2, Ore.
420 South San Pedro Street
Los Angeles 13, California

L. M. Parsons, formerly vice-president and general manager of sales of Jones and Laughlin Steel Corp., has joined United States Steel Corp. as assistant to vice-president of sales. He will be located at Washington, D. C.

» «

L. E. MacFadyen has been appointed works manager in charge of both the High Bridge, N. J., and Easton, Pa., plants of the Taylor-Wharton Iron and Steel Co. **James M. Sandt,** who was formerly assistant superintendent, succeeds Mr. MacFadyen at the Easton plant. **E. O. Swearingen** continues as superintendent of the High Bridge plant.

» «

Dr. W. D. Coolidge, inventor of the Coolidge X-ray tube and a world famous scientist, retired recently as vice-president and director of the General Electric Company's research laboratory. **Dr. C. G. Suits,** formerly assistant to the director of the research laboratory, has been elected a vice-president of G-E and will also be in charge of the research laboratory. Dr. Suits, one of the youngest of the country's prominent scientists, graduated from the University of Wisconsin in 1927. He is widely known for his research in high-temperature arcs.

» «

David C. Prince, vice-president of General Electric, has been placed in charge of the company's general engineering laboratory, the activities of which have been broadened to include the requirements of the entire company.

» «

Clinton R. Hanna, manager of the electro-mechanical department of Westinghouse research laboratories, has been appointed an associate director of the research laboratories. Mr. Hanna is the inventor of the tank-gun stabilizer which enables Allied tanks to fire accurately while in motion. He has made inventions covered by more than 80 patents in the United States and foreign countries. For his work in the development of the /tank gun stabilizer, he was awarded a Presidential Citation in 1942.

» «

Henry B. Bryans, executive vice-president and director of the Philadelphia Electric Co., has been re-elected president of the American Standards Association. Other officers for this year are: **George S. Case,** chairman of the board of the Lamson and Sessions Co., vice-president (re-elected); **H. S. Osborne,** American Telephone and Telegraph Co., chairman, Standards Council (re-elected); **E. C. Crittenden,** National Bureau of Standards, vice-chairman of Standards Council (re-elected).

» «

Archibald J. Cooper, formerly assistant manager, has been appointed manager of the Allis-Chalmers Mfg. Company's New York district office. He succeeds **A. F. Rolf,** who will now devote full time to his duties as assistant secretary.

"GENERAL" WELDING FUME EXHAUSTERS

For effective elimination of the *Noxious Fumes* from

Arc Welding
Galvanized Iron Soldering
Spray Painting, Etc.

TWO TO TEN INLETS—
For multiple hose connections in shop and field operations.

SINGLE INLET UNITS—
For exhaust from booth collector ducts; and in the smaller units.

High Velocity Exhaustion by High Speed Centrifugal Fans for Small, Easily Handled Hoses

SEMI-PORTABLES—
Movable by crane hook or carrying bar; or for fixed (duct) service. ¾ to 15 motor horsepower.

PORTABLE "JUNIORS"—
40 to 100 pounds in weight; one or two inlet nozzles.

Self-closing caps on all nozzles.
Rugged, all-steel construction.
Motored for continuous service.
Controls protected within base.

Bulletin CB-103 gives specifications and dimensions for the 18 types and sizes comprising the "General" line.

GENERAL BLOWER CO.

403 N. Peoria St., CANal 6340
New York CHICAGO 22, ILL. Detroit
Pittsburgh Philadelphia Cleveland

Theodore H. Diemer has been appointed assistant superintendent of industrial relations at the Gary Sheet and Tin mill. Mr. Diemer has been associated with Carnegie-Illinois for the last nine years. In his new position, he succeeds **William P. Jones,** recently transferred to the Pittsburgh industrial relations department of Carnegie-Illinois.

» «

A. R. Stargardter, formerly with the Eastern Stainless Steel Corp., Baltimore, as chief metallurgist has joined the Ajax Electric Co., Philadelphia, in the same capacity.

» «

Martin J. Conway, formerly special engineer in the sales department of Lukens Steel Co., has been appointed manager of the petroleum division of this firm. He is the author of numerous engineering papers on fuel economy, liquefied petroleum gases, uniflow engines and related subjects.

» «

Walter S. Dunker has been appointed assistant treasurer of the American Steel & Wire Co., Cleveland, subsidiary of U. S. Steel Corp. Since July of last year, he has been assistant treasurer and assistant chief accountant, Oakland, Calif., district of the company's Cyclone Fence division.

» «

Died . . .

Walter H. Girdler, Sr., president of The Girdler Corporation and Tube Turns, Louisville, died of a heart attack on Sunday, Jan. 7 at the age of 58. "The strains of war . . . undoubtedly shortened a crowded and productive life," the *Courier-Journal* commented editorially. "He labored day and night in the interest of America's part in the war. . . . He truly gave his life for his country."

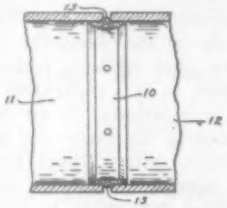
One of the pioneers in the welding industry, Mr. Girdler formed the Kentucky Oxygen-Hydrogen Company in 1917 and sold it to the Air Reduction Sales Company in 1929. Another of his well-known accomplishments was the development of a process and equipment for producing helium gas. This was of such great importance to the nation's welfare that the helium company properties were transferred to the U. S. Government in 1938.

Before the last war (about 1916), Mr. Girdler established one of the first oxygen and hydrogen plants south of the Ohio River. Prior and during the last war, he was very active in promoting welding equipment and welding gases. It was because of the promotion of pipe welding in connection with his company's activities that Mr. Girdler discovered Tube Turns. He and N. Keith Dunham acquired the rights for the manufacture of Tube Turns and started an industry which, in the past seventeen years, has grown to be a substantial factor in making pipe-line welding more effective.

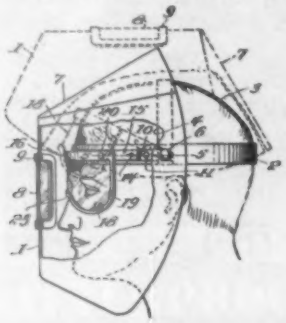
FROM THE PATENT OFFICE

Weld Back-up Ring

2,366,579. **Robert H. von Ahrens,** Portland, Ore. Filed Aug. 2, 1943. Issued Jan. 2, 1945.



A welding ring comprising an annular member having a cylindrical outer face and a plurality of substantially round protuberances punched out from its midsection and spaced circumferentially about the outer surface thereof. The protuberances are formed by punching from the opposite side of the member and are adapted to hold a pair of adjacent pipe ends the proper distance apart for welding. The cross-sectional shape is effective to preclude metal flow through the recess formed by the punching operation. The diameter of the recess formed by the punching out of the protuberances is sufficiently small so that surface tension alone prevents the passage of any molten metal when the protuberance has been melted by the welding process.



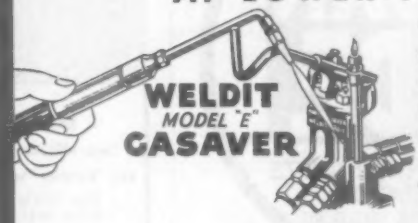
Weldor's Mask

2,363,461. **Francis D. Huntsman,** Salt Lake City, Utah, assigned to **Huntsman Welding Shield Co.,** Salt Lake City, a partnership. Filed March 29, 1943. Issued Nov. 21, 1944.

A face-protective device including a headband, an arcuate member of yieldable sheet material and an eyeshield. The arcuate member is pivotally associated near its ends with the sides of the headband and is swingable downwardly and upwardly from position in front. The eyeshield is mounted on and depends from the front of this member. An inclined surfaced projection on the inside of the member, near one of its pivotal points, contacts with the upper edge of the headband.

Safe Welding

AT LOWER PRODUCTION COSTS



The Weldit Gasaver shuts off the welding flame when not in use. . . . Conserves essential materials by cutting oxygen and acetylene consumption as much as *fifty* per cent. Prevents injury to workmen—or sudden fires—from dangerous idle torch flames. . . . Adjustment remains unaltered between welds.

When the Weldit Gasaver has been installed, you simply hang idle torch on the handy lever rod. Weight of torch pulls rod down, thus automatically shutting off supply lines. Relight instantly by passing torch over Gasaver pilot light. No bother. . . . No time lost. . . . *No readjusting required.* . . . Price $10.00 at Detroit. Order today.

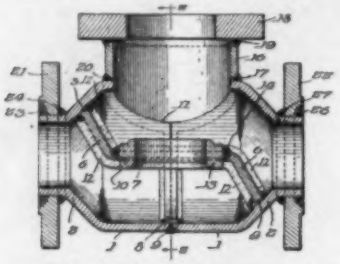
Better Soldering, Annealing and Heating Jobs

The Weldit Model CW Blowpipe is in daily use by many foremost industrial plants. . . . Built in accordance with the recommendations of leading fabricators of sheet metal products. . . . Operates on either natural gas, manufactured gas, or other low temperature fuel gas and compressed air. Stands up under rough shop use. . . . Send for literature.

WELDIT ACETYLENE CO.
628 BAGLEY AVENUE · DETROIT 26, MICH.

Weld-Fabricated Valve

2,363,943. **Otto M. Carlson,** Chicago, assigned to **Crane Co.,** Chicago. Filed Sept. 4, 1942. Issued Nov. 28, 1944.



A weld-fabricated valve casing comprising a pair of identical swaged tubular sections welded together to form the inlet and outlet. A pair of angular plate members, relieved to form a common aperture therebetween, are welded to an interior surface of the swaged tubular sections. At the juncture of the weld joining the tubular sections there is positioned a semicircular supporting member. The opposite ends of the supporting member terminate in a plane just below the weld joining the angular plate members adjacent to their common aperture.

» «

Mechanical Flash Remover

2,363,743. **Robert C. Palmer,** Youngstown, O. Filed July 23, 1942. Issued Nov. 28, 1944.

An internal flash remover for welded pipe. Body of the device is positioned within the pipe while a rotary motion is imparted to an elongated hammer. Hammer is positioned in an axially extending slot in the body and is capable of movement with respect to the slot so as to engage the flash. The means for imparting movement to the hammer comprises a shaft positioned in the body, an elongated cam on the shaft, means for holding the body in operative position within the pipe and connection to a power source for rotation of the shaft.

Electrode Holder

2,364,063. **James Forman** and **Andrew D. Clyburn,** New Orleans. Filed Dec. 21, 1942. Issued Dec. 5, 1944.

An electrode holder comprising a tubular member of insulating material, a member of conducting material mounted within the former tube, and a cap of conducting material mounted on an end of the conducting member and extending beyond the tubular member. Each of these members engages both of the other two to provide a rigid assembly. The cap has a plurality of intersecting sockets, each of which is adapted to receive an end of a welding electrode. A member having threaded engagement with the cap is adapted to clamp the electrode by engaging it at the intersection of the cap socket.

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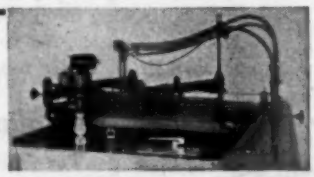
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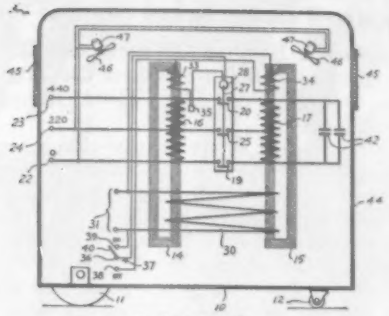

A-C Welder

2,364,881. **Joseph M. Tyrner,** Englewood, N. J., assigned to **Air Reduction Co., Inc.,** New York City. Filed Sept. 10, 1942. Issued Dec. 12, 1944.

An a-c arc-welding transformer with two primary windings connected in parallel through a switch. The switch is operated by means of an automatic control responsive to the flow of current in the secondary circuit which supplies the welding current.

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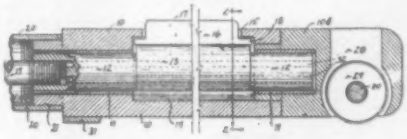
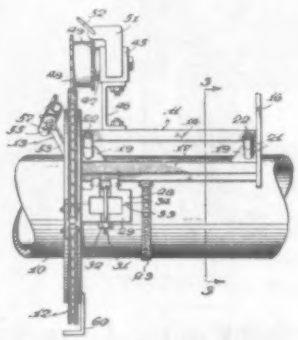


Spot-Welding Apparatus

2,363,719. **Joseph H. Cooper,** Warren, and **Clyde E. Smith,** Port Homer, O., assigned to **The Taylor-Winfield Corp.,** Warren, O. Filed Nov. 5, 1942. Issued Nov. 28, 1944.

A method of resistance welding which consists of applying electric current and pressure to the work at the point of weld, determining instantaneous values of the temperature attained at the point of weld, and controlling the strength of the current in accordance with the rate of temperature increase. Thus a predetermined rate of temperature increase may be effected.

» «



Pipe-Beveling Machine

2,364,963. **Bernard V. Elliott,** Bartlesville, Okla., assigned to **H. C. Price Co.,** Bartlesville.

This pipe-beveling machine includes a two-part ringlike supporting member and rigid braces extending laterally. The braces have interlocking opposed faces, and carry detachable securing means for clamping the face portions in order to rigidly secure the ring parts in alignment.

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Arc-Welding Safety Control

2,364,372. **Ralph S. Kenrick,** Chicago, assigned to **Pullman-Standard Car Mfg. Co.,** Chicago. Filed Sept. 7, 1942. Issued Dec. 5, 1944.

An automatic safety control circuit for arc welding. Elements are an a-c power source, a work circuit, a transformer having its primary connected to the power source and secondary delivering work current, and a control transformer. The latter has its primary connected to the power source and secondary delivering control current. In the circuit with the control transformer secondary is a control relay adapted to be energized upon completion of a starting circuit initiated by overloading the work circuit. A holding circuit is provided for maintaining the energization of this relay, a contact on the latter being adapted to complete the holding circuit upon energization of the relay. A power contactor relay, adapted to be connected in the circuit with the power source, is energized by the control relay to complete the work circuit through the main transformer secondary. The work circuit is isolated from the control circuit when the power contactor relay is energized.

» «

Spot-Welding Circuit

2,364,079. **Hans Klemperer,** Belmont, Mass., assigned to **Raytheon Mfg. Co.,** Newton, Mass. Filed April 15, 1943. Issued Dec. 5, 1944.

A spot-welding circuit comprising a condenser, means for charging it, a load circuit, means for discharging the condenser through the load circuit, means to terminate the flow of current from the condenser through the load circuit prior to the complete discharge of the condenser, and means to return remaining energy of the load back to the condenser in the same polarity as the charging means.

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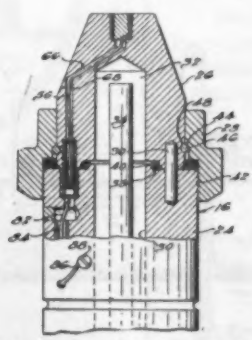
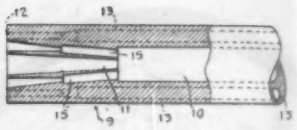


Spot-Welding Electrode

2,363,536. **Chester F. Leathers,** Detroit, assigned to **Progressive Welder Co.,** Detroit. Filed April 24, 1942. Issued Nov. 28, 1944.

The combination of a thermocouple element, a spot-welding electrode tip with a recess in the work-engaging surface, a plug received in the recess to form a support for the thermocouple, and a sleeve to support the plug and thermocouple. The sleeve is interposed between the wall of the recess and the plug.



Divergent Scarfing Tip

2,365,308. **Walter G. Sylvester,** Jersey City, N. J., assigned to **Air Reduction Co., Inc., New York City.** Filed March 28, 1942. Issued Dec. 19, 1944.

A torch tip for removing surface metal from a ferrous work-piece by directing an oxygen scarfing stream against the surface while the metal is at ignition temperature, together with auxiliary, high-velocity streams of oxygen. The latter are directed against the work-piece on both sides of the scarfing stream and are substantially smaller than the scarfing stream. They are delivered at atmospheric pressure from orifices which individually diverge outwardly and hence will not scarf the work-piece.

» «

Aluminum Cleaning

2,365,153. **Don E. Stevens,** South San Francisco, assigned to **Hammond Aircraft Co.,** South San Francisco. Filed Sept. 6, 1943. Issued Dec. 19, 1944.

The method of conditioning aluminum sheets for welding by first covering the surfaces of the sheets with a hydrofluoric acid solution until the oxide is broken and then covering the surfaces with a hydrochloric acid solution until the remaining oxide has been removed.

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